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s Guide
Book 5

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MATHEMATICS
LEARNING SYSTEM TEXT

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Canadian Publication

MATHEMATICS LEARNING SYSTEM

The Canadian publication of *Mathematics Learning System* is completely metric.

On some pages, major revisions have been made. In several cases the goal of the page has been altered, as indicated below:

Page 278 Adding like units of metric measure
Page 281 Progress Check — measuring centimetres
Page 282 Practice in measuring with a centimetre ruler
Page 299 Comparing measurements; practice with addition and subtraction skills
Page 300 Practice with equivalent measurements

On the following pages, the answers are as given below:

Substantial revisions have also been made in the pupils' text on pages 275, 276, 277, 278, 281, 282, 284, 299, 300, and 312, and minor ones on many other pages. These include several new illustrations, but do not affect the teaching of the program.

On the pages listed below, the answers in the Teacher's Guide are numerically correct for the questions in the pupils' text. However, the questions in the pupils' textbook have been altered to include only metric units.

Page 275 The questions now refer to litres, not pints and quarts.
Page 283 The answers now refer to kilometres, not miles.
Page 285 The answers now refer to (3a) centimetres, and (3b) metres.

Page 276
1a. Yes. 1000 ml = 1 litre
b. Buy 2 cartons
c. 2 packages
d. 2
2a. Yes
b. No. 1 metre = 100 cm
c. Buy it

Page 277
1a. 2000
b. 3000
2a. 2000
b. 3000
3a. 2000
b. 3000
4a. 200
b. 300
5a. Snik
b. 1 cm
6. 10 metres

Page 278
1. 10 cm
2. 9 m
3. 11 litres
4. 80 cm
5. 97 kg
6. 95 m
7. 39 g
8. 97 km
9. 77 ml
10. 11 m
11. 56 litres
12. 39 ml
13. 19 kg
14. 70 km
15. 38 cm

Page 281
1. 10
8
Accept 9 or 10
8
2. 10
15
15
10
3. 5
Accept 6 or 7
8
10

Page 282
All have a perimeter of 20 cm.

Page 284
a. metres
b. centimetres
c. centimetres
d. centimetres
e. centimetres
f. centimetres
g. centimetres
h. years
i. centimetres
j. kilograms
k. kilometres
l. cents
m. metres
n. grams
o. grams
p. hour

Page 299
1. 96 cm
2a. No
b. Yes
c. Yes
3. 24 kg
4. 95 kg
5. 80 g
6. 24 km

Page 300
1. 200, 300, 400
2. 2, 3, 10
3. 2000, 3000, 4000
4. 2, 3, 4
5. Mike, 10 cm
6. Cheese, 500 gm
7. Bottle, 200 ml

Page 311
11. 10 cm

Page 312
12. 3, 12
13. 8, 18
14. Between 1 and 3 metres
15. Between 50 and 100 kg
16. 12:30, 3:15, 5:45

Teacher's Guide
Level 3 Book 5

SRA MATHEMATICS LEARNING SYSTEM TEXT

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14 MEASUREMENT

before this chapter the learner has—

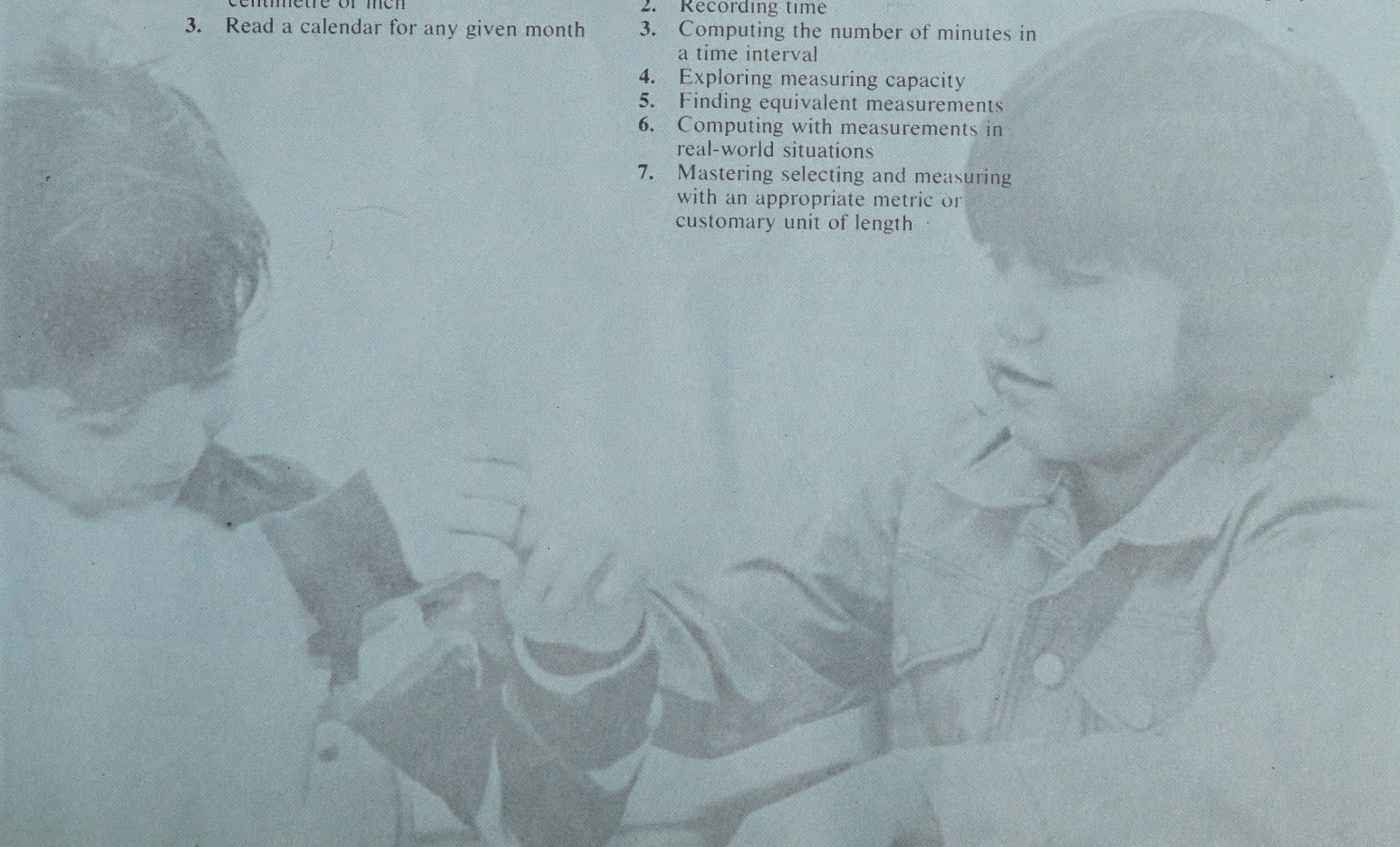
1. Told time to the half hour
2. Measured lengths to the nearest centimetre or inch
3. Read a calendar for any given month

in chapter 14 the learner is—

1. Mastering telling time to the nearest 5 minutes
2. Recording time
3. Computing the number of minutes in a time interval
4. Exploring measuring capacity
5. Finding equivalent measurements
6. Computing with measurements in real-world situations
7. Mastering selecting and measuring with an appropriate metric or customary unit of length

in later levels the learner will—

1. Master computing with measurements
2. Master finding equivalent fractions



Notes & Things

Have I got time to go to the shopping center and get that material for curtains?

You live 30 minutes away. It would cost too much to take a cab, but you could come by bus.

He got paid $1.20 an hour for trimming the hedge, and it took him 3 hours.

Do you have enough money to pay the babysitter? It has taken us much longer to get home than I thought it would.

Time, money, and distance are interrelated in many everyday situations in the adult world—and sometimes measurements get all mixed up. For example, we measure distance by time as well as by money.

Children are aware of these mix-ups long before they study the standard units of measure. This awareness is sometimes the reason for difficulties or disenchantment with measurement lessons in a math book.

The clock regulates the child's life as well as that of the adults.

It's time to

get up ... go to school ... go to recess ... go to lunch ... go home ... catch the bus ... meet dad ... practice your music ... eat ... watch TV ... take a bath ... go to bed. Learning how to read the clock is almost a survival skill! The child has had previous experience. This chapter polishes the final skill—telling time to the nearest five minutes.

Applying some knowledge of time allows a review and extension of the previous work with charts and tables. And charts and tables lead to some real applications of the arithmetic and measurement skills also acquired at this level. A subtitle for this chapter could have been "Getting It All Together."

Many of the activities will provide you with opportunities for some additional drill on the basic math skills in a new context. There are lots of activities that extend learning if you have some youngsters who need to be challenged.

things

spirit master of clockfaces
clockface model with movable hands
local TV schedule
milk cartons of various sizes
centimetre and inch rulers
yardsticks

For the extra activities you will want to have these things available:
powdered drink mix
transparent containers

goal Think about and explore ideas through picture clues

page 265 It's possible that none of the children have ever seen a clockface like the one in the photograph. Do they think it is a real clock? What do the words mean? Why might a clockface like this be used? Is there any way of knowing whether 11:00 means in the morning or at night? What does it probably mean? Why? When might the store's owner have left the store?

Is this sort of clockface sign better than a sign that says BE BACK IN 1 HOUR? What would be wrong with a sign such as that? Why is it important that a shopkeeper use a sign such as the clockface sign? Could that sort of sign be used by anyone other than a shopkeeper? Who might use it?

When a real clock shows 11:00, does that mean it is actually eleven o'clock? How could someone who didn't have a clock go about finding out the time? (Many telephone companies have a number to dial for the correct time. Does yours?)

You will have many opportunities for discussion in the chapter itself, so it's time for the next page.

lesson Page 266

goal **Survey**—telling time to the nearest 5 minutes

memo This is a very different survey. First of all, this one does not survey the whole chapter—only clocks. It is far more straightforward. In fact, it looks like a test. Reading a clock to tell the time is a skill. Either you know how to do it or you don't. So find out fast who needs to go methodically through this part of the chapter. Don't skip over the whole section with your sharpies. It has some good problem situations that will challenge everyone. The survey for liquid measure will come on a later page.

things spirit master of clockfaces

page 266 Problem 1 provides a quick survey of learner ability to read time on a clockface. Give additional help to those who have not yet mastered this skill. Use a clockface model with movable hands. The model can be made from a container with a plastic snap-on lid. Have the youngster trace the container and cut out a circular region to fit inside the lid. You'll have to help with marking the minutes and writing the numerals. Punch a hole in the center of the lid and the clockface. Attach the hands with a pronged paper fastener.

You'll need the duplicated copies of clockfaces for problem 2. It, too, can be used for additional practice.

Note that the answer key indicates the sequence of skills development.

There are—
60 minutes in 1 hour,
15 minutes in a quarter of an hour,
30 minutes in a half hour, and
45 minutes in three-quarters of an hour.

We say this clock shows four o'clock. We write 4:00.

Say—
15 minutes after 4
or a quarter after 4.

Write—4:15

LOOK OUT!

Say—
30 minutes after 4
or half past 4.

Write—4:30

Say—
15 minutes to 5
or a quarter to 5.

Write—4:45

The clock shows 12 hours. There are 24 hours in 1 day, so the hour hand on the clock goes all the way round 2 times in one day.

Is it 2:00 in the morning or in the afternoon?
You don't know without looking outside

People are coming to see you. They said to meet them at 10:00. Do you have to know more about the time? What? Yes Morning or night (A.M. or P.M.)

Please use the abbreviation A.M. to say that a time is after 12:00 midnight but before 12:00 noon. Use P.M. to say the time is after 12:00 noon but before 12:00 midnight.

lesson Pages 267, 268

goal Practice in telling time to the quarter hour; indicating A.M. or P.M.

page 267 To emphasize the concept of fractional parts of an hour, you may wish to draw clockfaces on the chalkboard. Shade in $\frac{1}{4}$ of a clockface to indicate 4:15, $\frac{1}{2}$ to indicate 4:30, and $\frac{3}{4}$ to indicate 4:45.

If we do not write A.M. *or* P.M. *after the time, how do we know whether it is 2:00 in the morning or in the afternoon?* You may wish to return to the duplicated clockfaces to provide additional practice, then have the pupils label the indicated time either A.M. or P.M.

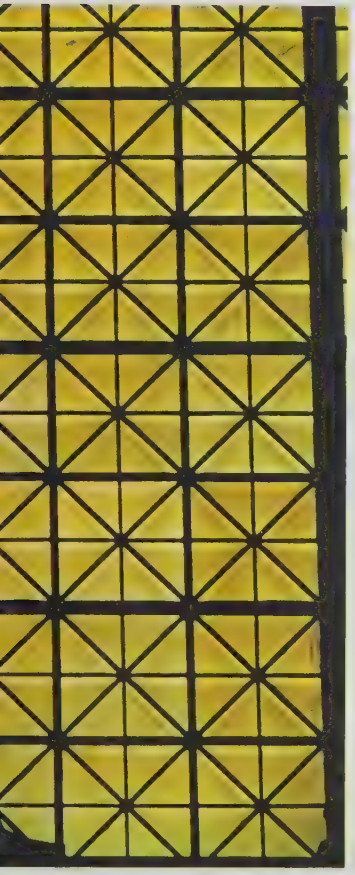
goal Practice in telling time to the nearest 5 minutes and recording the time

page 268 The clockface affords an opportunity to count by 5s, since each numeral indicates 5 minutes. *Does this remind you of other work we have done?* (Skip-counting in previous chapters) For learners who need the additional aid, you may have to write the multiples of 5 around the outer edge of a clockface drawn on the chalkboard. When in doubt on this page, use the clockface. Consider using the models on page 266.

If reading is a problem, you will have to take over. Be careful of problem 7. The times are stated verbally as **before** a given hour, yet they must be written as **after** the preceding hour.

1. How many minutes from—
   - **a** 9:00 to 9:30? 30
   - **b** 9:00 to 9:15? 15
   - **c** 9:15 to 9:30? 15
   - **d** 10:00 to 10:45? 45
   - **e** 10:45 to 11:00? 15
   - **f** 1:20 to 1:30? 10
   - **g** 3:30 to 3:45? 15
   - **h** 11:55 to 12:00? 5
   - **i** 12:00 to 1:00? 60
   - **j** 1:05 to 2:00? 55
2. The train was to arrive at 10:00 A.M. It got there at 10:10 A.M. How many minutes late was it? 10
3. He was to start work at 8:30 A.M. He started at 8:45 A.M. How many minutes was he late? 15
4. The appointment was for 3:20 P.M. He got there at 3:10 P.M. How many minutes early was he? 10
5. The bus left at 8:05 A.M. The trip took 20 minutes. What time did the bus get there? 8:25 A.M.
6. The shop closed at 11:30 for lunch. Lunchtime is 1 hour. What time does the shop open? 12:30 (P.M.)
7. Write the time when it is—
   - **a** 5 minutes before 4:00 3:55
   - **b** 30 minutes before noon 11:30 (A.M.)
   - **c** 15 minutes before 9:00 8:45
   - **d** 20 minutes before 2:00 1:40

268



He had to be in bed by 8:30 P.M. The clock said it was 7:45.
How many minutes before he went to bed? 45

Think from 7:45 to 8:00 is 15 minutes.
from 8:00 to 8:30 is 30 minutes.
Add 45 minutes in all.

1. Find out how many minutes there are from 11:55 A.M. to 12:05 P.M.

Think from 11:55 to 12:00 is 5 minutes.
from 12:00 to 12:05 is 5 minutes.
Add ? minutes in all.
10

2. Find out how many minutes—

	From	To			From	To	
a	2:30	3:10	40	**b**	6:45	7:15	30
c	5:30	6:15	45	**d**	11:20	12:15	55
e	9:15	10:15	60	**f**	3:00	4:30	90
g	8:15	8:55	40	**h**	4:35	5:10	35
i	1:25	1:55	30	**j**	2:20	3:35	75
k	4:40	5:05	25	**l**	7:55	8:10	15

3. The meat was to cook for $2\frac{1}{2}$ hours. It was started at 5:00. What time will it be done? 7:30

4. The music lesson started at 4:45. It lasted 45 minutes. What time was it over? 5:30

5. I was supposed to meet you at half past six. You waited until a quarter to seven and left. How long did you wait? 15 minutes

lesson Pages 269, 270, 271

goal Determining the number of minutes between two given times

page 269 A method for determining the number of minutes in a time interval is developed on the page. Some children will be able to reply intuitively because they have an acute sense of time.

Learners are free to use the method they can operate with best for problem 2—the computational method when it helps them. Watch out for **2e** and **f.** These look so simple that they can easily be misread. **2g** through **j** are more complicated.

Problems 3, 4, and 5 are strictly for group action.

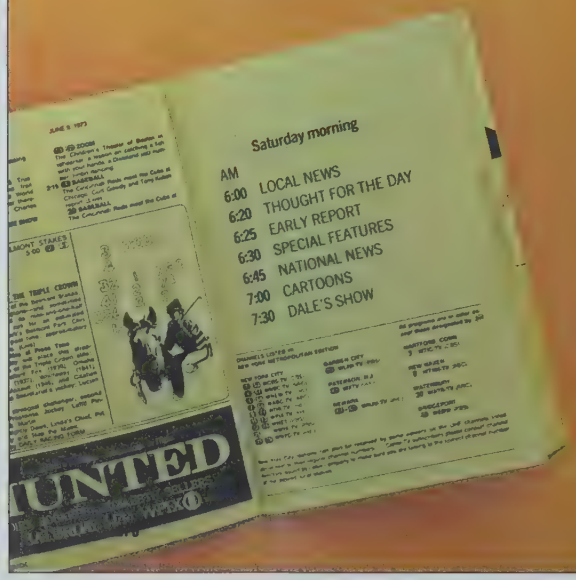
goal Applying the ability to determine the number of minutes in an interval to real-world situations

things local TV schedule

page 270 Compare the TV schedule shown to one from a local newspaper. The one in the text shows the listing for only one channel. Is this true of the newspaper schedule? How do the time intervals compare? Allow the youngsters complete freedom in organizing their charts for the last activity. Be sure to display these charts so they can be compared.

And be on the lookout for the child who has no TV at home; there are a surprising number of anti-TV families. How about switching to radio time or time while records or tapes are played at home?

Saturday morning's TV listing looks like this:



1. How many minutes for—
   - **a** local news?
   - **b** "Early Report"?
   - **c** special features?
   - **d** cartoons?
   - **e** "Dale's Show"?
2. Which is the longest program in the listing?
3. Which is the shortest program? Look carefully!
4. Let's say "Dale's Show" lasts 2 hours. When would it be over?
5. Make a chart to show how much time you watch TV in the next three days. Make the chart any way you want to. But make sure it shows the day and the amount of time.

Many people travel by train every day. There is a schedule that shows what time the train *leaves* a certain place. The schedule also shows what time it *arrives* at a certain place.

Leave city A	Arrive city B	Arrive city C
A.M.	A.M.	A.M.
8:05	8:50	9:25
10:35	11:15	11:50
P.M.	P.M.	P.M.
12:35	1:15	1:50
3:35	4:15	4:50
5:10	5:55	6:30
7:35	8:16	8:50

Here is part of a train schedule.
Look at it.
What does it tell you?
The time trains leave city A and arrive at city B and city C

1. If you leave city A at 8:05 A.M., when do you get to city B? to city C? 9:25
8:50
2. If you leave city A at 12:35 P.M., when do you get to city B? to city C? 1:50
1:15
3. It is afternoon. You are in city A. Your watch says ⟶ When is the next train to city C? 5:10
4. If you leave city A at 8:05 A.M., how many minutes before you can be in city B? 45 minutes
5. If you leave city A at 5:10, how many minutes before you can be in city C?
80 minutes (or 1 hour 20 minutes)
6. Could you go from city B to city C on this train? Yes

271

goal Reading a train schedule

page 271 The schedule shown on the page is an actual schedule. This is a hard page, but it is a very practical activity. It's great for playacting. This page is strictly for collective problem solving. Problems 4 and 5 may require some computation.

Let those youngsters who just love to compute determine the number of minutes from city A to city B, and from city B to city C, for each trip shown on the schedule. The times do not remain constant. *How can this be true?*

lesson Pages 272, 273, 274

goal Applications: telling time and computing money

page 272 Each problem situation involves two parts—one focusing on money, the other on time. You may need to help read these situations and give a hand in sorting the information for the first one or two problems. Make sure the youngsters realize that two separate computations are involved.

1. You left the house at 4:30. You had $1.00 to buy 1 pound of hamburger at the store. You got back at 4:45. You bought the hamburger. You have $.21 change.

   a How long were you gone? 15 minutes

   b How much money did you spend? $.79

2. You were going to a movie one Saturday afternoon. You had $2.00. You left at 2:00. You had $.50 when you got home at 5:00.

   a How long were you gone? 3 hours

   b How much money did you spend? $1.50

3. You and your brother were going to visit your friend one morning. You have $1.50 and an O.K. to buy one thing. You leave at 9:00. You get home at noon. You have $.15 left.

   a How long were you gone? 3 hours

   b How much money did you spend? $1.35

4. You left for the hobby store at 4:15. You were supposed to be home in half an hour. You got what you wanted. It cost $.69. You got home at 5:00.

   a Were you late? How do you know?
   Yes You were supposed to be home at 4:45.

   b How much change did you have left from $1.00? $.31

5. Your turn to make up a problem like the ones on this page. Make it real if you can. Problems will vary.

272

1. Bob bought
   1 malt 40¢
   1 hotdog 35¢
   How much did they cost? 75¢

2. Eve bought
   1 hamburger 50¢
   1 french fries 25¢
   How much did they cost? 75¢

3. Al bought
   2 hotdogs 70¢
   1 root beer 10¢
   How much did they cost? 80¢

4. Lyn bought
   2 apples 20¢
   2 oranges 20¢
   How much did they cost? 40¢

5. Big Bill bought
   2 hamburgers $1.00
   1 french fries .25
   1 malt .40
   How much did they cost? $1.65

6. Little Lill bought
   2 hotdogs $.70
   2 ice-cream cups .40
   1 milk .10
   How much did they cost? $1.20

7. What would you buy if you were going to have lunch? How much would the food cost that you plan to buy?
   Answers will vary with individual choices.
   BE PREPARED: Someone may ask about the sales tax on his total bill.

273

goal Applying arithmetic skills to shopping

page 273 Many pupils will be capable of mentally computing these costs. Marvelous! Use paper and pencil only if necessary. Careful of problems 5 and 6—the sums are over a dollar. Be ready for the youngster who asks about the sales tax.

goal Finding the shortest distance on a map

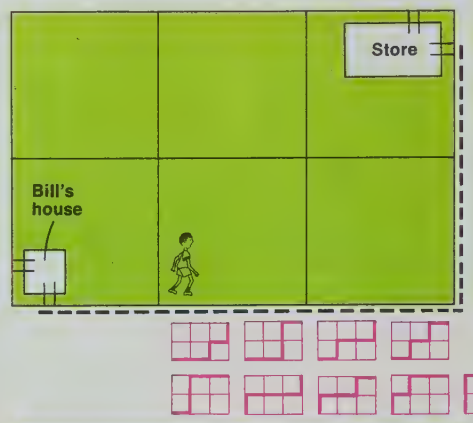
page 274 Several paths are possible on each map pictured. Since overlapping paths can cause confusion, you may wish to have learners make several copies of each map or use a different color of crayon for each path. Using graph paper is another possibility.

The youngsters may wish to exchange the maps they make for problem 4 and challenge a classmate to try finding the shortest path.

1. Bill often went to the store. He didn't mind going. He liked to take a different way as often as he could. Here is a map of where he lives. It also shows the store. Each large square shows one square block.

The dotted line shows one path he can walk to the store. How many blocks would he walk on this path? Could he walk another path? Yes

5



2. Copy this map on your paper.

a Mark the other paths that he could walk. The rules are that he must walk on the sidewalk. No fair cutting across a block.

b Is one path you found shorter than any other? No

3. Here's another map. This shows where Sara lives. Does she live farther away from the store than Bill? Yes

a Sara always rides her bike to the store. You know she can't cut across lawns. Copy the map on your paper. Show the paths that Sara could take. Rotate maps shown to see more paths.

b Is one path shorter than any other? No

4. Draw a map of where you live. Show your path to a place you often go—to school, to a store, to a playground, or to a friend's house. Maps will vary.

274

Talk about this page.

Pretend you have to go to the store.
You have to buy milk.

What units are used to measure a liquid?

pint

quart

gallon

1. Make a list of all the liquids you can think of that you might buy. Tell which unit of measure would be best to describe each one.
2. Can a pint of milk fit into another container that is a different shape? Yes
3. Can a quart of paint fit into another container that is a different shape? Yes

In countries where the metric system is used, the quart measure is not used. They use a *litre* as a measure. A quart is just about the same amount.

In metric measure you don't have to worry about pints or gallons. Most liquids are sold by the litre or a fractional part of a litre.

275

See activity 1, page 285a.

Consider frozen liquids. *What are some frozen liquids? How are they measured?* Ice cream in certain specialty shops is packed by hand and sold by the pound. Generally, however, ice cream is sold by the pint, quart, half-gallon, or gallon.

lesson Pages 275, 276

goal **Survey**—units of liquid measure

things milk cartons of various sizes

page 275 Don't expect the youngsters to know all the answers here. Customary units of liquid measure are confusing—to say the least. There is no basic measure: quarts, pints, gallons, or even fluid ounces can be used. There's a difference between the number of fluid ounces in a pint and the number of dry ounces in a pound despite the old saying, "A pint's a pound the world around."

With children of this age, it will be wise to limit customary liquid measure to those units they know about. Include the $\frac{1}{2}$ pint of milk with lunch or $\frac{1}{2}$ pint of whipping cream, along with the $\frac{1}{2}$ gallon milk container found in so many homes.

Please don't make a big point of the fractional part of a litre. The fractional part is expressed as a decimal fraction rather than a common fraction, and your pupils aren't ready for this yet.

goal Using arithmetic skills to make shopping decisions

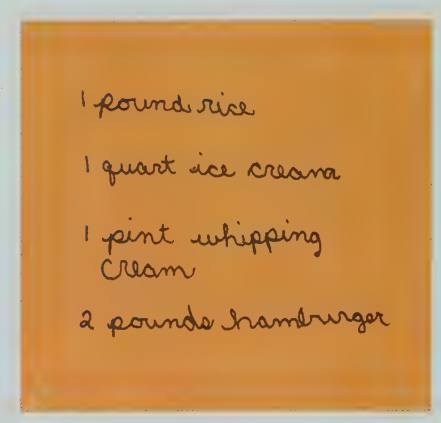
page 276 This discussion page provides a quick survey of your pupils' ability to use equivalent units of measure in the customary system. The focus is on making decisions while shopping.

The relationships emphasized in the problems may be summarized in a chart.

1 pound = 16 ounces
2 pints = 1 quart
(and so on)

The various units may then be classified under **liquid** measure, **weight,** or **length.**

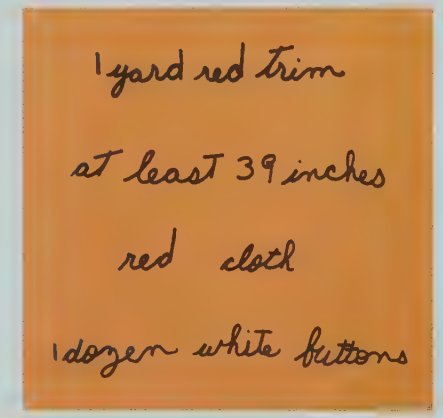
1. One day when Bill went to the grocery store he had trouble. The things he was supposed to buy were on a list.
He looked and looked, but
it didn't help.
   - **a** The package of rice said 16 ounces. Should he buy it? Yes—1 pound = 16 ounces
   - **b** There were no quart packages of ice cream. There were only pints. What should he do? Buy 2 pints
   - **c** There were no pints of whipping cream. There were only $\frac{1}{2}$ pints. How many should he buy? Buy 2 half-pints
   - **d** The hamburger was in 1-pound packages. How many packages should he buy? 2



2. Sara had to get some things from the department store. She had a list too. And she had trouble too! She looked and looked, but
it didn't help.
   - **a** The package of red trim said 3 feet. Should she buy it? Yes
   - **b** There was 1 yard of red cloth left. Would this be enough? Should she buy it? No
   - **c** She didn't know how many buttons would be the same number as 1 dozen. Do you know? How many? 12

No

Do you ever have problems like this when you go shopping? Encourage sharing related shopping experiences.



276

1. 1 pound = 16 ounces
- **a** 2 pounds = ? ounces 32
- **b** 3 pounds = ? ounces 48

2. 1 foot = 12 inches
- **a** 2 feet = ? inches 24
- **b** 3 feet = ? inches 36

3. 1 yard = 3 feet
- **a** 2 yards = ? feet 6
- **b** 3 yards = ? feet 9

4. 1 metre = 100 centimetres
- **a** 2 metres = ? centimetres 200
- **b** 3 metres = ? centimetres 300

5. 1 quart = 2 pints
- **a** 2 quarts = ? pints 4
- **b** 3 quarts = ? pints 6

6. 1 yard = 36 inches
- **a** 2 yards = ? inches 72
- **b** 3 yards = ? inches 108

7. There was a race.
Snor and Snik Snail were off and running.

Snor went 1 centimetre. Then he rested. He raced another 2 centimetres and then stopped. Finally, he went 1 more centimetre before the time for the race was over.

Snik went 2 centimetres before he rested and then 2 more centimetres. He was tired. He went 1 more centimetre before the race had ended.

- **a** Who went the greater distance? Snik
- **b** How much farther did the winner go? 1 cm

8. Jake knew the door was 7 feet high. He knew that the distance between the top of the door and the ceiling was 3 more feet. About how far is it from the floor to the ceiling? 10 feet

lesson Pages 277, 278

goal Finding equivalent measurements

page 277 The equivalent measurements in problems 1 through 6 can be determined by either repeated addition or multiplication. The learner is free to choose the method he feels most comfortable with. Note that only related equivalent measurements are requested. No attempt is made to convert from customary to metric units or vice versa.

Encourage the youngsters to make simple illustrations for problems 7 and 8. The illustrations are a means to check comprehension. You may need to help with reading.

goal Adding like units of customary measure

page 278 You may not want to use the whole page. That's O.K. Answers here are not complete unless the unit of measure is named. All learners should compute at least problems 1 through 6.

The remainder of the page provides a glimpse of the future and requires careful guidance. Problem 10 requires renaming and should be attempted only by your most capable pupils.

You can add measurements.

$$\begin{array}{r} 3 \text{ inches} \\ +4 \text{ inches} \\ \hline 7 \text{ inches} \end{array}$$

Total Units of Measure

Try these

1. 4 ounces + 6 ounces = 10 ounces
2. 3 yards + 6 yards = 9 yards
3. 4 gallons + 7 gallons = 11 gallons
4. 50 centimetres + 30 centimetres = 80 centimetres
5. 34 pounds + 63 pounds = 97 pounds
6. 45 metres + 50 metres = 95 metres

You might see a problem like this someday →

3 feet 2 inches
+ 2 feet 8 inches
? feet ? inches

What do you think the answer is?

5 feet 10 inches

There are no new rules. Add the inches. Then add the feet.

Try some like this

7. 2 feet 5 inches + 3 feet 4 inches = 5 feet 9 inches
8. 2 gallons 1 quart + 1 gallon 2 quarts = 3 gallons 3 quarts
9. 2 yards 1 foot + 9 yards 1 foot = 11 yards 2 feet

*10. 9 yards 2 feet + 2 yards 2 feet = 11 yards 4 feet ←

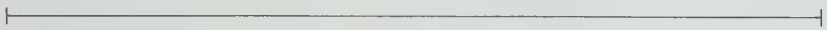
Are there any yards in the total number of feet? Yes
Could you rename the answer? Yes
How many yards in all? How many feet remain? 1
12 Answer could be renamed as 12 yards 1 foot.

278

1. If a teeny, tiny ant had to walk on the black line along each of the paths below, which path would be the longest walk? Both are the same length.

Path A

Path B



How can you check to make sure? Measure each one.

One way to check would be to use a ruler. If you don't have a ruler marked with centimetres, copy this one.

2. Let's suppose that same ant had to walk on the black lines below that form squares, rectangles, and triangles. Measure how far he would have to walk if he went all the way around each shape.

a

12 cm

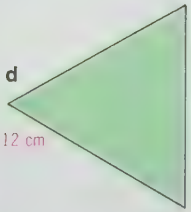
b

14 cm

c

16 cm

d



12 cm

279

lesson Pages 279, 280, 281

goal Practice in measuring with a centimetre ruler

things centimetre rulers

page 279 If the youngsters don't have a centimetre ruler, have them make a copy of the ruler on the page. Have them extend it a few more centimetres to accommodate path B. Or consider duplicating the ruler on a spirit master. These will be used again on page 280. A sharpie should be able to estimate the distance by comparing path B to the ruler model.

Measuring the sides of the various figures pictured and then adding to find the total distance around will provide additional practice in computation. But there is no need to introduce perimeter here.

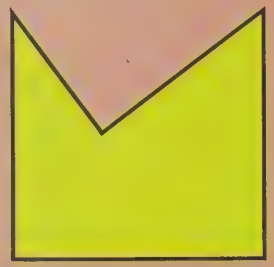
goal Practice in measuring with a centimetre ruler

things centimetre rulers

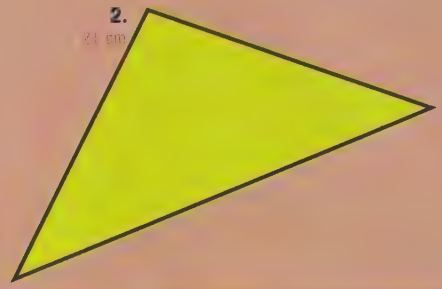
page 280 The focus is on gaining experience in measuring and computing measurements by finding the distance around each figure.

Measure the distance around
each of these figures.
Use your centimetre ruler.

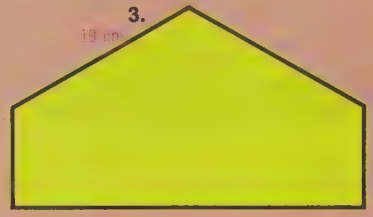
1.



2.

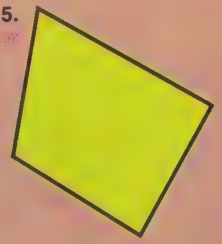


3.



4.

5.



6.

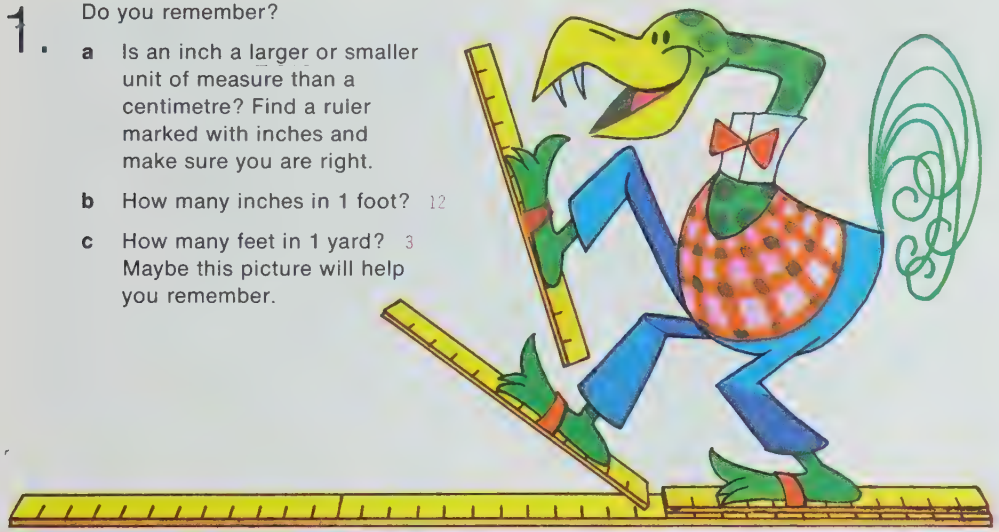
280

1. Do you remember?

a Is an inch a larger or smaller unit of measure than a centimetre? Find a ruler marked with inches and make sure you are right.

b How many inches in 1 foot? 12

c How many feet in 1 yard? 3
Maybe this picture will help you remember.



***2.** Copy the table and fill in the boxes where there are question marks.

inches	1	? 12	? 36	? 48	? 72	? 360	
feet		1	? 3	4	? 6	? 30	? 5280
yards			1		2	10	1,760
miles							1

281

goal Changing customary measurements of length to equivalent measurements

things inch rulers
yardsticks

page 281 You'll want the children to examine rulers and yardsticks to establish the relationships while discussing exercise 1.

Problem 2 is very hard and can be done as a group project. The emphasis is on computational practice rather than on memorization of equivalent measures. Changing yards to feet and then to inches will be a challenge for most learners. Why not use a reference book to determine the number of feet in 1760 yards? Computation is not always necessary when a reference is available.

lesson Page 282

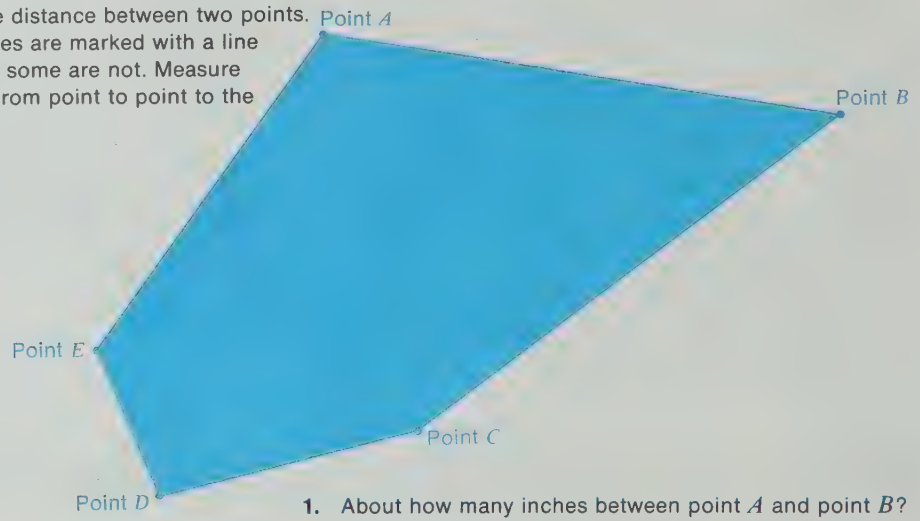
goal **Progress Check**—measuring inches

things inch rulers

page 282 You may want to give the directions verbally so that the youngsters can concentrate on measuring. Measurements to the nearest inch are satisfactory.

After completing the Progress Check, return to problems 2 and 3. *Is the distance between B and A the same as the distance between A and B?* Similar comparisons can be made between the distances from C to A and A to C and C to B and B to C. *When measuring the distance between two points, can we begin with either point?*

Use your ruler marked with inches. You'll be finding the distance between two points. Some distances are marked with a line segment, and some are not. Measure the distance from point to point to the nearest inch.



1. About how many inches between point A and point B? 4
   between point A and point C? 3
   between A and D? 4
   A and E? 3

2. About how many inches between point B and point C? 4
   between point B and point D? 6
   between B and E? 6
   B and A? 4

3. About how many inches between point C and point D? 2
   between point C and point E? Accept 2 or 3.
   between C and A? 3
   C and B? 4

282

See activity 2, page 285a.

See activity 3, page 285a.

1 Mrs. Jay liked to walk. She lived close enough to her job so that she could walk to work. She walked 1 mile to work every morning. She walked 1 mile home every night.

a How many miles did she walk every day back and forth to work? 2

b She worked 4 days a week. How many miles did she walk back and forth to work every week? 8

2 Mr. Jay had to go 19 miles to the place he worked. He drove a car. Every day he drove 19 miles to work in the morning. He drove 19 miles back home every night.

a How many miles did he drive every day back and forth to work? 38

b He worked 5 days a week. How many miles did he drive back and forth in a week? 190

c There are usually 4 weeks in a month. How many miles did he drive back and forth in a month? 760

3 How far do you travel to get to school each day?
Answers will vary. Look for obvious errors.

a How far do you travel back and forth each day?

b How far each week?

c How far in 1 month?

4 How many hours do you spend in school each day? How many hours in a week? in a month?
Answers will vary according to your schoolday's length.

283

lesson Pages 283, 284

goal Solving word problems involving measurements

page 283 Do not expect everyone to handle all the problems on this page. You might have those who want to try all of them tell the others how they solved these problems.

goal Selecting an appropriate unit of measure

page 284 You may wish to review the units of measure that could possibly be used by listing them randomly on the board. *What unit measures can you remember that could be used?* This will help with spelling too.

Learners who had difficulty in assigning an appropriate unit of measure can work with you in classifying the various unit names under the headings: weight, length, capacity. Once classified, these may be ordered from smallest unit to largest. You may wish to separate customary units from metric units.

Forgetful Fred forgot more than he remembered. He was supposed to find some measurements. He wrote down each measurement on a piece of paper. But he forgot to write down the unit of measure he used. He had a scale. But he forgot whether the scale measured pounds, ounces, or grams. We know he had a yardstick and a metrestick. Of course he can't find them now. He forgot where he put them.

What standard unit of measure might be right for these measurements that Fred wrote down?
Examples given

a door - 7 high feet

b board eraser - 5 long inches

c pencil - 6 [illegible] inches

d plant - 12 high centimetres or inches

e book - 21 wide centimetres or inches

f my hand - 4 centimetres or inches

i me - 48 high inches

9 Dad - 6 high feet
15 old years
Brother -

j me - 80 heavy pounds or kilograms

k walk home - 2 miles or kilometres

l lunch cost - 30 cents

m my room - 10 long feet, yards, or metres

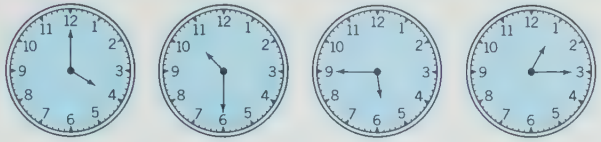
n milk for lunch - 2 glasses, pints, or ounces

o letter - 4 heavy ounces or grams

p time this took me - 1 minute, hour, day, afternoon, and so on

284

1. Write the time each clockface shows.



a 4:00 **b** 10:30 **c** 5:45 **d** 1:15

2. They had to practice their music lesson for 30 minutes.

Skill: Computing in time measures

a Jay started at noon. When did he finish? 12:30 P.M.

b Jan started at 4:30 P.M. When did she finish? 5:00 P.M.

c Jake started at 6:15 P.M. When did he finish? 6:45 P.M.

d Jill started at 6:45 P.M. When did she finish? 7:15 P.M.

3. Answer these questions. Skill: Adding two-measures expressed in like units of measure

a 4 inches and 5 inches more.
How many inches in all? 9

b 1 foot and 2 feet more.
How many feet in all? 3 (or 1 yard)

c 20 centimetres and 50 centimetres more.
How many in all? 70

d 35 cents and 45 more cents.
How many cents in all? 80

e 29 cents and 49 more cents.
How many cents in all? 78

Skill: Measuring lengths

4. Measure and record the length and width of this book.
About 10-by-8 in. or about 25-by-20 cm

285

See activities 4 and 5, page 285b.

Puzzlers:

1. What is the weight of a box that weighs 5 pounds plus half of its total weight? (10)
2. A train one mile long is traveling at a speed of one mile a minute. How long will it take this train to go through a tunnel that is one mile long? (2 min.)

lesson Page 285

goal **Checkout**—telling time, computing with measurements, measuring inches

things inch and centimetre rulers

page 285 Pupils may measure the page in either centimetres or inches in problem 4. Remind them to include the unit name when recording the measurement. You will want to observe individual pupils as they perform this task. How does he handle the ruler? How does he keep track of the measures? Does he proceed with confidence?

RESOURCES

another form of evaluation

for Progress Check—page 282

1. Draw 3 straight lines on your paper. Put a point at both ends of each line. Find the distance from point to point on each line by measuring to the nearest inch.
   Answers will vary.
2. Draw a 4-sided figure on your paper. Put a point at each corner of your figure. Label one point A, one point B, one point C, and one point D. Measure the distance from point to point to the nearest inch. About how many inches between—
   a) Point A and point B?
   b) Point B and point C?
   c) Point C and point D?
   d) Point D and point A?
   e) Point A and point C?
   f) Point B and point D?
   Answers will vary.

for Checkout—page 285

1. Write the time each clockface shows.

(a) 3:00 (b) 7:30 (c) 6:45 (d) 12:15

2. They could have the playground for 30 minutes.
   a) Grade 1 went out at noon. When must they come in? 12:30 P.M.
   b) Grade 3 took over at 1:00 P.M. When will they come in? 1:30 P.M.
   c) Grade 6 went out at 12:30 P.M. When do they come in? 1:00 P.M.
   d) Grade 4 went out at 1:45 P.M. When do they come in? 2:15 P.M.
3. Answer these questions.
   a) 6 inches and 3 inches more. How many in all ? 9
   b) 3 feet and 1 foot more. How many feet in all? 4
   c) 25 centimetres and 5 centimetres more. How many in all? 30
   d) 50 cents and 30 cents more. How many cents in all? 80
   e) 51 cents and 48 cents more. How many cents in all? 99

activities

1. things powdered drink mix, transparent containers of several sizes and shapes, water

A tasty and colorful drink mix can be a novel teaching aid! The color is more visible when the liquid is poured from one container to another and stimulates learner interest—especially when the mixture is consumed at the end of the activity.

Have a pupil measure a given quantity of the liquid mixture and then pour it from one container to another. *Does the amount remain the same when poured from one container to another?* (If none is spilled!) *Does it look like the same amount? Must we always use the same-shape container for this amount? Will the mixture fit into containers of many different shapes?*

You may wish to repeat the activity with a given amount of dry weight in containers of different sizes and shapes.

2. things empty boxes; rulers

Have pupils measure (to the nearest inch or centimetre) the length and the width of a box and attach the appropriate labels.

Repeat with several boxes. Then have the pupils compare sets of 2 boxes. *Which box is longer? How long is it? Which box is shorter? How much shorter?* Use sets of 3 boxes to find the longest, shortest, tallest. Also find which side of a box is the shortest side.

3. things graph paper

Suppose that each side of a square on the paper is 1 foot long. You have 36 feet of fence wire and want to build a dog pen. What different shapes could you make the pen? When you finish, decide which shape pen would be the best for your dog.

4. things adding-machine tape, felt pens of 2 colors

Cut 10 strips of adding-machine tape to measure 1 yard long. Mark these strips with one felt pen to read: **1 yard—3 feet—36 inches**. Cut another 10 strips to measure 1 metre each. Mark these strips with the other felt pen to read: **1 metre—100 centimetres**. Pupils will be able to see the lengths as well as to compute with them.

5. things real clock with movable hands

Clocks with the hands still intact are great to help youngsters grasp the idea of the movement of the hands. Setting various times on the clockface makes it possible to see that the minute hand moves all the way around the face before the hour hand reaches the next hour. You might encourage the youngsters to bring in discarded clocks.

Have the youngsters show 4:20 on the clock. Then show the time 15 minutes later, an hour and 10 minutes—or any number of minutes—later.

additional learning aids

concept—chapter objectives 1, 2, 3, 4, 5, 6, 7, 8

SRA products

diagnosis: an instructional aid—Mathematics Level A, SRA, 1973)
Probe: L-20
Skill through Patterns, level 3, SRA (1974)
Spirit masters: 57, 58

other learning aids (described on page 312i)—Judy Clock, Judy Mini-Clocks, Learning about Measurement, Tell-Time Quizmo

15 COMPUTATION

before this chapter the learner has—

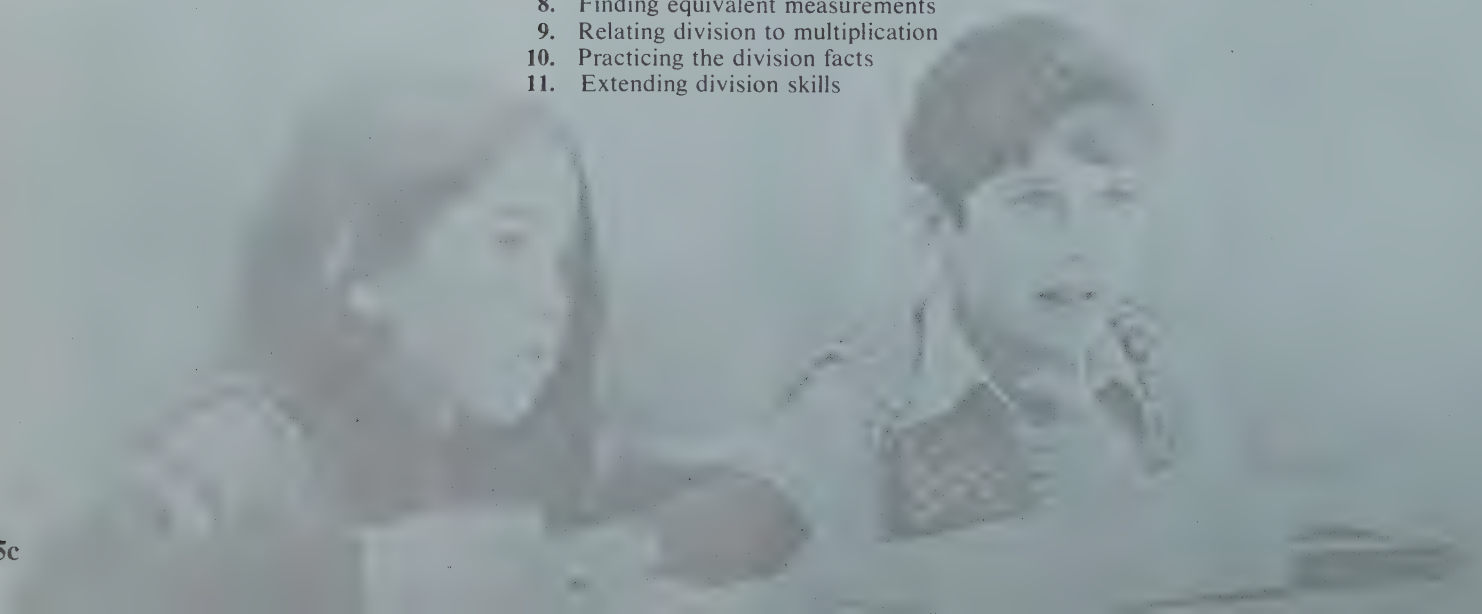
Developed the concepts, practiced or mastered the skills to be reviewed in this chapter

in chapter 15 the learner is—

1. Reviewing finding the sum or difference of any 3-digit numbers
2. Reviewing finding the sum of three 2-digit numbers
3. Reviewing the multiplication facts
4. Mastering finding the product of a 2-digit factor multiplied by a 1-digit factor
5. Reviewing telling the value of each digit of a 4-digit number
6. Showing that the order in which 3 or more factors are multiplied does not affect their product
7. Comparing measurements
8. Finding equivalent measurements
9. Relating division to multiplication
10. Practicing the division facts
11. Extending division skills

in later levels the learner will—

1. Maintain the skills mastered
2. Apply and extend the concepts and skills mastered



Notes & Things

This review chapter starts very nearly at the beginning of the learner's arithmetic experiences, but all the work is put into a new context. Patterns of odd and even numbers allow one last view of each child's strengths and weaknesses in addition and subtraction. By this time error patterns should be quite obvious. Practice on the weak spots can and should extend beyond this chapter.

The concept of estimation is introduced for the first time. Estimation is one of the most valuable skills any pupil learns in elementary school. It is a skill that adults use almost daily. Think about the number of times you use the skill when you go shopping for groceries, for example. Estimation is a major thrust in level 4. This chapter provides readiness for estimating. It also allows a review of the remaining computational skills covered in this level.

Division is extended in this chapter beyond the objectives for this level. We found that the placement of this skill was perhaps the most controversial issue in the years of field testing that have preceded publication of these materials. Please look at this section carefully. Compare the coverage with your own expectations as well as with your school's curriculum. You may want to do some alterations on this part of the chapter.

The Checkout will allow you to look at each child's performance in relation to the year-end objectives. We know you will be proud of the children's progress and achievement. And you deserve a gold star for your efforts.

things

wood cubes
rulers
yardsticks and metresticks

goal Think about and explore ideas through a picture clue

page 286 Believe it or not, the photograph is a real hallway in a building in New York. It is used as a symbol for this chapter. And the symbol is quite sophisticated—maybe too much so for your group.

The youngsters have gone along a hallway, building skills as they progressed through this book. They are just about ready to enter the doorway of a new level of study. Is everybody ready? Let's find out. Make it clear that it's O.K. if someone makes a turn to investigate another part of that hallway. All turns lead to the same door sooner or later—the door to the next level. The youngsters who must take time out for extra practice in this chapter need the assurance that every person will make it to the new beginning.

Your goal in this chapter is to get it all together! Find out more about addition, subtraction, multiplication, AND division.

The numbers 1, 3, 5, 7, 9, and 11 are called odd numbers.
The numbers 2, 4, 6, 8, 10, and 12 are called even numbers.
All numbers that end with an even number are also even.

1. Try to list the next nine odd numbers that come after 11. 13, 15, 17, 19, 21, 23, 25, 27, 29

2. Try to list the next eight even numbers that come after 12. 14, 16, 18, 20, 22, 24, 26, 28

3. Add these odd numbers. Skill: Addition facts

a	b	c	d	e	f	g	h	
1	3	5	7	9	7	5	3	
+ 3	+ 5	+ 7	+ 9	+ 7	+ 5	+ 3	+ 1	Are your answers odd or even numbers?
4	8	12	16	16	12	8	4	

4. Add these even numbers.

a	b	c	d	e	f	g	h	
2	4	6	8	10	8	6	4	
+ 4	+ 6	+ 8	+ 10	+ 8	+ 6	+ 4	+ 2	Are your answers odd or even?
6	10	14	18	18	14	10	6	

5. Add these odd and even numbers.

a	b	c	d	e	f	g	h	
1	2	3	4	5	6	8	9	
+ 2	+ 3	+ 4	+ 5	+ 6	+ 7	+ 9	+ 10	Are your answers odd or even?
3	5	7	9	11	13	17	19	

287

See activity 1, page 312a.

lesson Pages 287, 288

goal Review of addition facts

warm-up Draw 3 parallel lines on the board. Make 1 square, 2 squares, and 3 squares between the lines, as shown.

The first figure shows the number 1. Point to the second and third figures and ask what number is shown. Ask someone to come to the board and represent 4. Then ask another to represent 5, 6, and so on, up to 10. *Do you see a pattern to these figures?* (The figures that represent 2, 4, 6, 8, 10 are rectangles; 3, 5, 7, 9 are not.) You now have another way to discuss the **even** and **odd** numbers featured on the pupil page.

page 287 The concept of even and odd numbers provides a different context for a complete review of addition skills. If a pupil becomes interested in the concept of odds and evens, or if you think a manipulative experience would help those children who are still having trouble with the facts, go further with the squares.

goal Practice in adding two 2- or 3-digit numbers with renaming

page 288 A careful examination of the pupils' completed work on this page will perhaps reveal an error that could be easily straightened out with just a bit of help from you. Perhaps the following will assist you in detecting the "how in heaven's name did you get this answer" type of error.

```
  80
+ 29
  19
   0
  19
```

This is the 10 that comes from 8 + 2. Help this child by turning the problem into a money situation. *You have 80 pennies. I give you 29 pennies more. How many do you have now?*

```
   °
  76
+  4
   1
  10
  11
```

Oh my! This child's work will quickly reveal his problem. He needs to know that when he adds two 1-digit numbers, the most or least number of tens he will rename is 1 ten. He knows the addition facts, and he may know that 10 is the same number as 1 ten and 0 ones; his problem is in recording in the correct place-value column.

What do you think?

Skill: Addition of 2- and 3-digit numbers, no renaming

1. Do you think the odd and even pattern will hold for the addition of larger numbers too? If the pattern holds true, your answers to this row of addition will be even. Find the sums to make sure.

a	**b**	**c**	**d**	**e**
51 + 35 = 86	357 + 31 = 388	735 + 53 = 788	555 + 111 = 666	757 + 131 = 888

Skill: Addition of 2- and 3-digit numbers, with renaming

2. Will the sums be even if you have to rename? Find out. Yes

a	**b**	**c***	**d***	**e***
57 + 13 = 70	739 + 17 = 756	577 + 53 = 630	791 + 139 = 930	975 + 197 = 1172

3. Now add to see if your answer is odd when you add evens and odds. It is.

a	**b**	**c***	**d***	**e***
57 + 24 = 81	642 + 39 = 681	735 + 88 = 823	864 + 137 = 1001	753 + 248 = 1001

4. Did it make a change in the sum if the order of evens and odds was changed? Now add evens. No

a	**b**	**c**	**d***	**e***
24 + 46 = 70	168 + 24 = 192	246 + 28 = 274	486 + 124 = 610	826 + 184 = 1010

*Renaming more than once

288

Skill: Subtraction facts

FIND OUT

1. What happens when you subtract odd numbers?

a	b	c	d	e	f	g	h
3	5	7	9	9	9	7	7
− 1	− 3	− 5	− 7	− 5	− 3	− 3	− 1
2	2	2	2	4	6	4	6

Are your answers odd or even?

2. Subtract these even numbers.

a	b	c	d	e	f	g	h
4	6	8	6	8	8	10	10
− 2	− 2	− 2	− 4	− 4	− 6	− 8	− 6
2	4	6	2	4	2	2	4

Are your answers odd or even?

3. But what happens when you subtract evens from odds?

a	b	c	d	e	f	g	h
3	5	7	7	7	9	9	9
− 2	− 2	− 2	− 4	− 6	− 4	− 6	− 8
1	3	5	3	1	5	3	1

4. Try subtracting odds from evens.

a	b	c	d	e	f	g	h
4	6	8	8	10	6	10	4
− 3	− 3	− 3	− 5	− 5	− 5	− 7	− 1
1	3	5	3	5	1	3	3

5. Are your answers odd or even in problems 3 and 4?

6. Will the odd-and-even pattern hold for the subtraction of larger numbers, too? Yes

lesson Pages 289, 290

goal Review of subtraction facts

page 289 The basic facts checked are limited. If you suspect that the child has not mastered the more difficult combinations shown below, check him out with subtraction flash cards or any programmed drill material you have.

11 − 2	11 − 3	11 − 4 ...
12 − 3	12 − 4	12 − 5 ...
13 − 4	13 − 5	13 − 6 ...
14 − 5	14 − 6	14 − 7 ...

through 18 − 9

goal Practice in subtracting 2- and 3-digit numbers with renaming

page 290 As you correct papers, look out for the following types of errors:

$$\begin{array}{r} 5\,17\,18 \\ \cancel{6}\,\cancel{7}\,\cancel{8} \\ -\ 99 \\ \hline 589 \end{array}$$ Or it might be written $$\begin{array}{r} 5\,1\,18 \\ \cancel{6}\,\cancel{7}\,\cancel{8} \\ -\ 99 \\ \hline 589 \end{array}$$

These children know the facts, but they are mixed up about renaming. They would benefit from more practice with two 2-digit numbers requiring renaming from tens to ones. You may want to use manipulatives to reinforce the breaking up of the ten.

As you move to 3-digit numbers, determine in which way the pupil can best handle renaming.

$$\begin{array}{r} {\scriptstyle 16\,18} \\ 6\cancel{7}\cancel{8} \\ -\ 99 \\ \hline \end{array}$$ One position at a time.

Or

$$\begin{array}{r} {\scriptstyle 5\,16} \\ {\scriptstyle \not{6}\,\not{7}\,18} \\ \cancel{6}\,\cancel{7}\,\cancel{8} \\ -\ 99 \\ \hline \end{array}$$ Complete all the renaming and then compute.

Skill: Subtraction of 2- and 3-digit numbers, no renaming

1. Think about odd and even numbers again. Look at these problems. Will you get odd or even answers? Subtract to make sure.

a	b	c	d	e
79 − 51 = 28	395 − 73 = 322	179 − 31 = 148	977 − 153 = 824	753 − 531 = 222

Skill: Subtraction, with renaming

2. Will you get even numbers when you subtract odd numbers that need renaming? Yes
Here's a set of problems to help you find out.

a	b	c*	d*	e*
97 − 59 = 38	353 − 49 = 304	551 − 75 = 476	931 − 357 = 574	735 − 579 = 156

3. Now subtract to see if your answer is odd when you subtract an even from an odd. It is
(There's some renaming.)

a	b	c	d*	e*
79 − 46 = 33	383 − 62 = 321	595 − 246 = 349	737 − 468 = 269	975 − 686 = 289

4. Now subtract odd from even. (There's some renaming.) Your answers are odd.

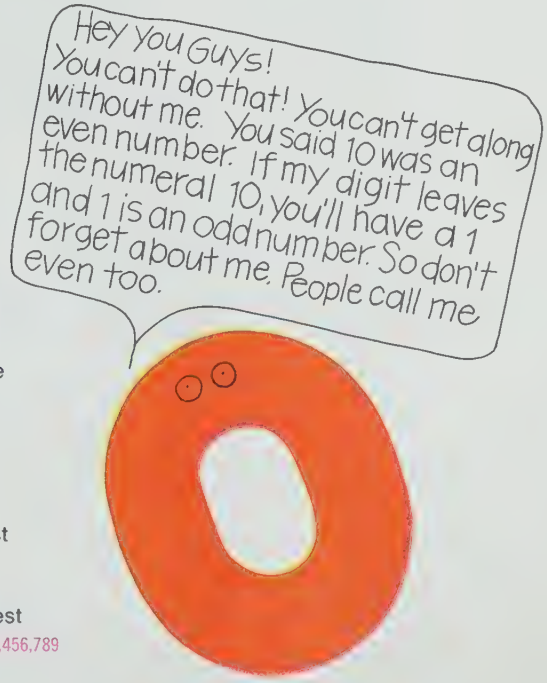
a	b	c	d*	e
88 − 57 = 31	268 − 35 = 233	484 − 55 = 429	824 − 537 = 287	888 − 733 = 155

5. Make up five problems that show your answer will be even if you subtract two large even numbers. Answers will vary with individual choice of numbers.

*Renaming more than once

290

Have you noticed? Poor Zero! He didn't get in on the act. Oh well, maybe he isn't important. Can you forget about him?


Hey you Guys!
You can't do that! You can't get along without me. You said 10 was an even number. If my digit leaves the numeral 10, you'll have a 1 and 1 is an odd number. So don't forget about me. People call me even too.

Zero is a very important number.
Think about all ten of our digits.

0 1 2 3 4 5 6 7 8 9

You can make just about any number in the whole world with these ten digits.

1. Use any one of the digits to write the smallest whole number you know. 0

2. Use all of the digits just once. Write the largest number you can. 9,876,543,210

3. Use all of the digits just once. Write the smallest number you can. Accept either 1,023,456,789 or (0),123,456,789

4. **Think** What makes one order of digits show a larger number than any other order?
Place value of the digits (Accept other good answers.)

lesson Page 291

goal Examining the digit 0

page 291 You'll want to talk about poor ol' zero's complaint. Emphasize the importance of zero in place value with such numbers as 3056, 204, 101, 30, 4000. Remove the zeros and have new numbers read.

The numbers that the pupil writes for problems 1, 2, and 3 will be a good indication of his grasp of place value.

Be sure to discuss problem 4.

lesson Pages 292, 293, 294

goal Introduction to the concept of estimation

memo Good guesses serve as an introduction to estimation. Beginning in level 4, estimations are emphasized as a way to anticipate the reasonableness of a computed answer. The next several pages build a foundation for this later work.

page 292 Discuss the examples together. Ask the youngsters to jot down guesses for row 1. Examine these. Stress that there are no wrong guesses. What makes some guesses better than others?

Be careful of capable learners who do not make a guess but who actually compute the answer mentally, because these problems are simple for them. That's O.K. But they, too, must learn to estimate so that they can use this skill with more difficult computation. Challenge them with some more difficult problems.

The emphasis for the remainder of this page, as well as page 293, is on making a good guess.

It is so sad when you make a silly mistake. No one wants to make mistakes. There are some things that you can learn to help you not make silly mistakes when you are adding.

You know your addition facts, don't you? So start from there.

Look at this problem.

$$\begin{array}{r} 52 \\ +\ 43 \\ \hline 95 \end{array}$$

You know your answer has to be less than 100. Why? $50 + 40 = 90$ (estimate)
About what will the answer be? About 90

$$\begin{array}{r} 67 \\ +\ 79 \\ \hline 146 \end{array}$$

You know this answer will be more than 100 but less than 200. Why? $70 + 80 = 150$ (estimate)
Can you guess about what the answer will be? About 150.

1. Look at these problems and guess what the answer will be.
Don't compute. Just make a good guess.

a	11	10	**b**	38	40	**c**	97	100	**d**	20	20	**e**	67	70
	+ 22	+ 20		+ 52	+ 50		+ 90	+ 90		+ 37	+ 40		+ 82	+ 80
		30			90			190			60			150

There is no such thing as a wrong guess.
But some guesses are better than others.

Time out to learn how to make a good guess.

Here is how you start.
Look at each number and **THINK**.

$$\begin{array}{r} 11 \\ +\ 22 \\ \hline ? \end{array}$$

That's close to 10.
That's close to 20.
10 + 20 is 30, so
the answer will be close to 30.

The **THINK** step is the important step.

292

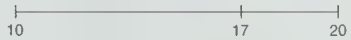
Before you can really get good at guessing, you have to be able to add tens *and* "think" the number line. You want to find the number of tens another number is closest to. You want tens because you can work without pencil and paper. You just showed you could.

1. Answer these without using paper and pencil.

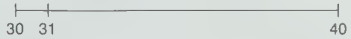
a	b	c	d	e	f	g	h
10	40	60	70	80	60	70	80
+ 30	+ 50	+ 20	+ 80	+ 90	+ 40	+ 60	+ 80
40	90	80	150	170	100	130	160

That proves you can add tens.
Now see if you can "think" the number line.

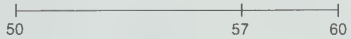
2. Is 17 closer to 10 or 20?



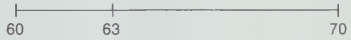
3. Is 31 closer to 30 or 40?



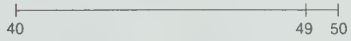
4. Is 57 closer to 50 or 60?



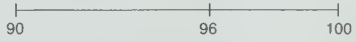
5. Is 63 closer to 60 or 70?



6. Is 49 closer to 40 or 50?

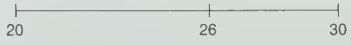


7. Is 96 closer to 90 or 100?



8. Is 82 closer to 80 or 90?

9. Is 26 closer to 20 or 30?



10. Is 74 closer to 70 or 80?

293

goal Practice with prerequisite skills for making an estimate

page 293 Problem 1 should be independent work. Direct pupils who have difficulty with problem 1 to cover the zeros and look at the addition facts only.

Use problems 2 and 3 as a group. Check on the understanding of **closer.** The remainder of the page should be independent work. Continue to page 294 and complete the number-line work.

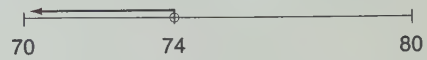
goal Practice in rounding and estimating

page 294 Get the rounding rules all settled. Then use these rules to estimate. Discuss problem 1. Have the pupils compute actual sums to verify their closeness to the estimate.

Problem 2 can be independent work. The rounding steps should be done mentally for the estimated sums, but paper and pencil are in order for the computed sums.

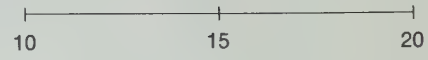
You just finished *rounding* numbers. You rounded a number up to a number of tens.

Or you rounded a number down.



There was one number that wasn't in your rounding practice.

Is 15 closer to 10 or 20?



There has to be an agreement.

Numbers like 15, 25, 35, and 55 are halfway numbers.
They are not closer to one ten than to another.
Agree, please, that halfway numbers will be rounded up.

1. Now back to addition and making good guesses about the answers.

a
$$\begin{array}{r} 37 \\ +\ 42 \\ \hline ? \end{array} \quad \begin{array}{l} \longrightarrow \text{round up to} \longrightarrow 40 \\ \longrightarrow \text{round down to} \longrightarrow +\ 40 \end{array}$$

The real answer had better be close to 80. Is it? Yes—79

b
$$\begin{array}{r} 52 \\ +\ 63 \\ \hline ? \end{array} \quad \begin{array}{l} \longrightarrow 50 \\ \longrightarrow +\ 60 \end{array}$$

Close to 110. Is it? Yes

c
$$\begin{array}{r} 89 \\ +\ 76 \\ \hline ? \end{array} \quad \begin{array}{l} \longrightarrow 90 \\ \longrightarrow +\ 80 \end{array}$$

Close to 170. Is it? Yes

d
$$\begin{array}{r} 91 \\ +\ 69 \\ \hline ? \end{array} \quad \begin{array}{l} \longrightarrow 90 \\ \longrightarrow +\ 70 \end{array}$$

Close to 160. Is it? Yes

2. Try these. First write your guess. Then find out how close your good guess is to the real answer.

a		**b**		**c**		**d**		**e**	
72	70	85	90	31	30	54	50	99	100
+ 47	+ 50	+ 29	+ 30	+ 69	+ 70	+ 19	+ 20	+ 38	+ 40
119	120	114	120	100	100	73	70	137	140

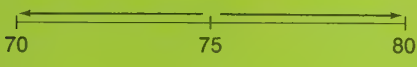
294

1. Check to see how good you are at subtracting without paper and pencil.

a	90	**b**	60	**c**	70	**d**	80	**e**	50
	− 30		− 50		− 40		− 50		− 30
	60		10		30		30		20
f	110	**g**	150	**h**	180	**i**	160	**j**	140
	− 30		− 70		− 90		− 80		− 50
	80		80		90		80		90

If you know your subtraction facts, those problems are easy.
If you don't know them, the problems might be hard.

2. Now a quick review of rounding.



71, 72, 73, and 74 all round down to 70.

75, 76, 77, 78, and 79 round up to 80.

You know that segment could have been marked 10 through 20. How else could it have been marked?

Any two multiples of 10 Examples: 20–30, 30–40, and so on.

3. Put the subtracting-ten skill with your rounding skill and show what good guesses you can make.

a 67 → round up to → 70
− 38 → round up to → − 40
29

The real answer should be close to 30. Is it? Yes

First write your guess. Then find out how close your guess is to the answer.

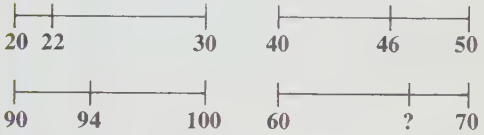
b	86	90	**c**	52	50	**d**	94	90	**e**	148	150	**f**	183	180
	− 49	− 50		− 34	− 30		− 57	− 60		− 62	− 60		− 79	− 80
	37	40		18	20		37	30		86	90		104	100

lesson Pages 295, 296

goal Extension of estimation skills to subtraction

page 295 Problems 1 and 2 are practice with prerequisite skills for estimating differences. You decide how best to handle this work, dependent upon the success your pupils had with estimating sums.

You may want to expand problem 2 with more examples on the board.



For problem 3, the rounding should be completed mentally, the estimated sum should be recorded, and then the computation should be done. How close are the estimates to the computed answers?

goal Extension of estimation skills to multiplication

page 296 Problem 1 is practice with a skill prerequisite to estimating products. Pupils need record answers only.

Help the youngster who experiences trouble to see this sequence:

3	3 tens	30
× 3	× 3	× 3
9	9 tens	90

You decide whether or not the youngsters are ready to complete any part of this page on their own.

1. Try multiplication. Answer these. Don't write the problem.

a 30 × 3 = 90	**b** 40 × 6 = 240	**c** 50 × 7 = 350	**d** 60 × 4 = 240	**e** 70 × 7 = 490
f 80 × 5 = 400	**g** 90 × 6 = 540	**h** 60 × 3 = 180	**i** 80 × 7 = 560	**j** 40 × 9 = 360

2. Can you make a good guess when you multiply?

a 41 × 9 = ? → 369

THINK 41 is closer to 40 than 50. I know 9 × 40 is 360. So my answer should be a little more than 360. Is it? Yes

b 73 × 7 = ? → 511

THINK 73 is closer to 70 than 80. I know 7 × 70 is 490. So my answer should be a little more than 490. Is it? Yes

c 95 × 8 = ? → 760

THINK 95 is between 90 and 100. I'll use 100 to make my guess. 8 × 100 is 800. My answer should be a little less than 800. Is it? Yes

d 54 × 6 = ? → 324

THINK 54 is closer to 50 than 60. What's 6 × 50? My answer should be a little more than ? (300). Is it? Yes

e 69 × 5 = ? → 345

THINK 69 is closer to 70 than 60. What's 5 × 70? My answer should be a little less than ? (350). Is it? Yes

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Do you need some practice in multiplication? One group decided the game of cubes was good for fun and practice, too.

They used only two cubes. They put fresh tape on the cubes. They marked one of these numerals on each face—1, 2, 3, 4, 5, 6. On the other cube they put the numeral 7 on two faces, 8 on two faces, and 9 on two faces. (They wanted the most practice on 7, 8, and 9.) They rolled the cubes. The person who had the turn had to say the product.

They decided not to put zero on any face of the cubes. Can you figure out why?

0 times any number equals zero; these facts would be too easy.

They decided to change the game. They got a third cube. They marked that cube with 1, 2, 3, 4, 5, 6. They rolled all three cubes. This time the person had to name the product of three factors. See how fast you could write the products for each turn.

1.	2	3	7	42	**2.**	4	5	7	140
3.	5	2	9	90	**4.**	7	5	1	35
5.	3	8	4	96	**6.**	6	3	8	144
7.	5	9	1	45	**8.**	6	7	4	168
9.	8	6	2	96	**10.**	9	1	6	54
11.	3	9	2	54	**12.**	8	4	5	160

Does it matter which two numbers you multiply first?

Not to the product, but the way you group factors may make the multiplication easier to do.

297

lesson Page 297

goal Practice in multiplying three numbers

things wood cubes

page 297 As with addition when more than two numbers are involved, the way the numbers are grouped for multiplication does not affect the product. Actually playing the game described on the page would reveal this generalization to the pupils and generate more practice.

Two types of additional practice are possible:

- Basic facts—use only 2 cubes.
- Multiplying a 2-digit factor by a 1-digit factor—use 3 cubes.

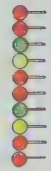
lesson Pages 298, 299, 300

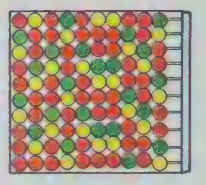
goal Review of multiplication skills

memo This page kicks off a double review. Both computation skills and knowledge of measurement will be used in a 3-page sequence.

page 298 The emphasis in problems 1 through 7 is on multiplying multiples of 10, 100, and 1000. This skill is essential when working with metric measures. Problems 8 and 9 provide practice in multiplying a 2-digit factor by a 1-digit factor—an important skill when working with customary measure.

Wouldn't it be great to visit a lollipop factory? There are such things, you know. One factory makes strings of 10 lollipops. They put 10 strings of 10 in one box. And they put 10 boxes in just one carton.





1. How many lollipops in one box? 100
2. How many in the carton? 1000
3. A candy store ordered 5 cartons. How many lollipops? 5000
4. Debby was planning a party. She needed 50 lollipops. How many strings should she buy? 5
5. Each lollipop costs 2 cents. How much does 1 string cost? 20¢
6. How much does a box of them cost? $2.00
7. Here's a hard one. How much would a whole carton cost? $20.00
8. The candy store also sold candy by the pound. Each pound of chocolate candy costs $.69.

If you bought	2 pounds	3 pounds	5 pounds
You would pay	? $1.38	? $2.07	? $3.45

9. Hard candy costs only $.37 a pound.

If you bought	2 pounds	4 pounds	6 pounds
You would pay	? $.74	? $1.48	? $2.22

298

See activities 2 and 3, page 312a.

Start with this information.

There are 100 centimetres in 1 metre.

There are 36 inches in 1 yard.
A yard is less than 1 metre.

There are 1000 metres in 1 kilometre.

There are 1760 yards in 1 mile.
A kilometre is less than 1 mile.

1. The poodle took his owner for a 1-kilometre walk.
The hound took his owner for a 1-mile walk.
Who had the longer walk? The hound and his owner

2. Bill threw the football 20 yards.
His sister threw it 20 metres.
Who threw it the greater distance? His sister

3. Zeke's turtle ran for 100 centimetres in the race.
Abe's turtle ran for 100 inches.
Whose turtle went the greater distance? Abe's turtle

4. They needed at least 3 metres of rope.
   - **a** Ruth had 3 yards. Was that enough? No
   - **b** Jake had 250 centimetres. Was that enough? No
   - **c** Paula had 6 feet of rope. Was that enough? No
   - **d** Mr. Jones had 300 centimetres. Was that enough? Yes

5. Sam's family traveled 1000 miles on vacation.
Tina's family traveled 1000 kilometres on their trip.
   - **a** Who traveled the longer distance? Sam's family
   - **b** Do you know which family might have been away from home the longer time?
     No, but to say Sam's family would be the better "good guess."

goal Comparing measurements and deciding which is more

page 299 This is a hard page. Please note that the youngsters need not make an exact comparison of units of measure for these questions.

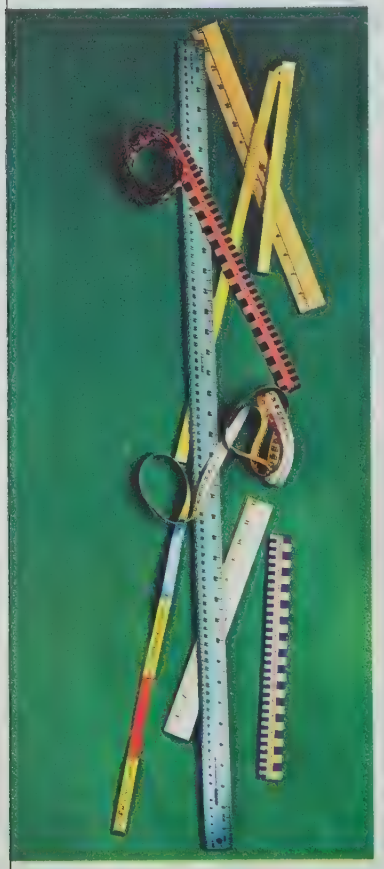
Before beginning, review together: *Which is longer— a metre or a yard? a kilometre or a mile? a centimetre or an inch?* You may want to summarize this information in a chart on the chalkboard.

goal Practice in finding equivalent measurements; practice with multiplication skills

things rulers
yardsticks
metresticks

page 300 Pupils need not memorize equivalent measurements. Problems 1 through 4 are designed to provide multiplication practice in a measurement setting.

Problem 5 relies on the child's memory and his feel for the given units of measure. If any children have difficulty deciding, encourage them to use an actual ruler, yardstick, or metrestick and make the actual comparisons.



300

1. Do you remember how long 1 inch is?
|—| That shows 1 inch. How many inches in 1 foot? Get a ruler if you have forgotten.

The length of a ribbon is	1 foot	2 feet	3 feet	5 feet
It also measures	12 inches	? inches 24	? inches 36	? inches 60

2. Do you remember how many feet in 1 yard? Find a yardstick to remind yourself how long 1 yard is.

The length of a string is	1 yard	2 yards	3 yards	10 yards
It also measures	3 feet	? feet 6	? feet 9	? feet 30

3. Do you remember how many inches in 1 yard? Look at the yardstick if you have forgotten.

The length of a rope is	1 yard	2 yards	3 yards	10 yards
It also measures	36 inches	? inches 72	? inches 108	? inches 360

4. Do you remember how long 1 centimetre is?
|—| That shows 1 centimetre. How many centimetres in 1 metre? *Centimetre* is a long word to write. Use the abbreviation, cm, to stand for centimetres.

The length of tape is	1 metre	2 metres	3 metres	10 metres
It also measures	100 cm	? cm 200	? cm 300	? cm 1000

5. Which is longer?

a 1 cm or 1 inch
b 1 foot or 1 yard
c 1 metre or 1 foot
d 12 inches or 1 yard
e 1 metre or 1 yard
f 36 inches or 100 cm

Multiply and divide

These problems all follow a pattern. Can you find it?

For every multiplication problem, you can write two division problems.

1. $7 \times 6 = 42$	$7\overline{)42}$ (6)	$6\overline{)42}$ (7)	
2. $9 \times 3 = 27$	$3\overline{)27}$ (9)	$9\overline{)27}$ (3)	
3. $8 \times 5 = 40$	$8\overline{)40}$ (5)	$5\overline{)40}$ (8)	
4. $8 \times 2 = 16$	$8\overline{)16}$ (2)	$2\overline{)16}$ (8)	
5. $4 \times 9 = 36$	$4\overline{)36}$ (9)	$9\overline{)36}$ (4)	
6. $9 \times 6 = 54$	$9\overline{)54}$ (6)	$6\overline{)54}$ (9)	
7. $4 \times 7 = 28$	$4\overline{)28}$ (7)	$7\overline{)28}$ (4)	
8. $5 \times 6 = 30$	$5\overline{)30}$ (6)	$6\overline{)30}$ (5)	
9. $8 \times 7 = 56$	$8\overline{)56}$ (7)	$7\overline{)56}$ (8)	
10. $8 \times 9 = 72$	$8\overline{)72}$ (9)	$9\overline{)72}$ (8)	
11. $6 \times 8 = 48$	$6\overline{)48}$ (8)	$8\overline{)48}$ (6)	
12. $9 \times 7 = 63$	$9\overline{)63}$ (7)	$7\overline{)63}$ (9)	

13. Make up three sets of problems like those you have just finished.

Selections will vary, but they should follow the above models. Look out for errors using 1 or 0.

Your multiplication facts can help you with division.

lesson Pages 301, 302

goal Relating division to multiplication

page 301 Another review. How do the factors and product change positions from multiplication to division? This is independent work. You might want pupils to compare their work for problem 13.

As an added challenge, consider—

$6 \times 6 = 36$

Are 2 division facts possible? Why, or why not?

goal Writing multiplication and division sentences

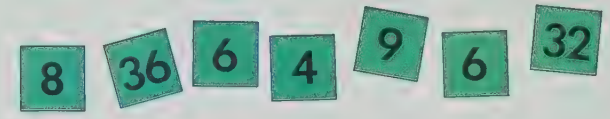
page 302 Check to make sure that the division sentences are true. For example:

this $36 \div 6 = 6$ *not this* $6 \div 36 = 6$

Trying to verify a false sentence by using manipulatives should take care of the trouble.

You will have a chance to talk about the order of factors in the multiplication sentences. $6 \times 8 = 48$ and $8 \times 6 = 48$ can be considered two different sentences, but the product is certainly the same.

1. Write all the ways you can find to fit any three of these number tiles into the division sentence.



$36 \div 4 =$
$36 \div 9 =$
$36 \div 6 =$
$32 \div 4$
$32 \div 8$

2. Write the different ways you could fit any three of the number tiles above into this multiplication sentence.

$4 \times 8 =$
$8 \times 4 =$
$6 \times 6 =$
$4 \times 9 =$
$9 \times 4 =$

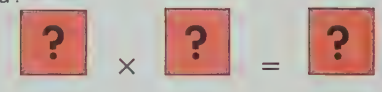
3. This time use any three of these number tiles. How many different sentences can you find?

Answer depends on individual total. Total possible: 6

$48 \div 6$
$48 \div 8$
$56 \div 7$
$56 \div 8$
$54 \div 6$
$54 \div 9$

4. Switch to multiplication. How many different sentences can you find?

Answer depends on individual total. Total possible: 6



$6 \times 8 =$
$8 \times 6 =$
$7 \times 8 =$
$8 \times 7 =$
$6 \times 9 =$
$9 \times 6 =$

302

1. Pretend you are a storekeeper. Some things come in large packages. You want to sell them in smaller packages. So you repackage them. Tell how many smaller packages you would get.

Item	It comes in big package with this many inside	Number of smaller packages you want to sell	How many in each smaller package?	
a candy bars	12	3	?	4
b soap	24	3	?	8
c gum	36	6	?	6
d light bulbs	4	1	?	4
e ice-cream bars	12	2	?	6
f lotion	6	2	?	3
g tissues	48	6	?	8

You have been dividing.
You didn't estimate this time.
You needed to know exactly how many things would go in each smaller package.

2. Here is when you might estimate.

a Pretend you are planning a party. 8 people in all will be there. The box of cookies says there are 36 cookies in it. You want 3 cookies for each person. Will you have enough? Yes

b You bought a big bag of balloons. It has 12 balloons in it. Can each person have a balloon? Yes

c You have 6 party hats. Can each person have one? No

lesson Page 303

goal Extension of the concept of estimation to division

page 303 Problem 1 can be completed by **thinking** missing factor in multiplication ($3 \times ? = 12$) or **thinking** division ($12 \div 3 = 4$). Pupils need not write these sentences—mental computation is super!

Problem 1 shows the need for an exact answer, while problem 2 shows that an **estimate** is O.K. Can anyone think of other times when an estimate is all that is needed?

lesson Page 304

goal Exploring the concept of divisibility

memo This is extension work. You may wish to skip the page or expand the work—depending upon your curriculum and the abilities of your pupils.

page 304 When can a number be divided evenly, without a remainder? When dividing by one of its factors!

Treat this page as exciting **grownup** work. Move slowly to avoid confusion. Follow the thinking pattern presented on the page.

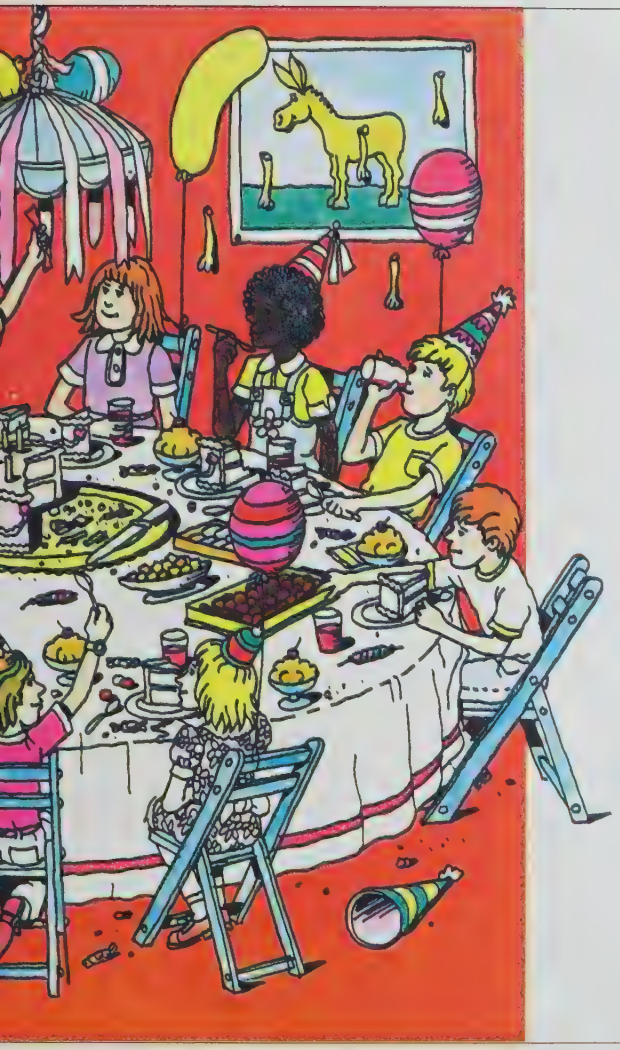
1. There are 12 people at the party. You plan to play different games.
   - **a** One game calls for teams of 2. How many teams would there be? 6
   - **b** Another calls for teams of 3. How many teams this time? 4
   - **c** Now you need teams of 4. How many teams of 4? 3
   - **d** Could you play a game with teams of 6? Yes How many teams of 6 could there be? 2

2. There are 15 people. Could everybody play a game that called for—
   - **a** teams of 2? No How many teams could play? 7
   - **b** teams of 3? Yes How many teams could play? 5
   - **c** teams of 4? No How many teams could play? 3
   - **d** teams of 5? Yes How many teams could play? 3
   - **e** teams of 6? No How many teams could play? 2

3. Now you have 20 people. Could you play a game that called for—
   - **a** teams of 2? Yes How many teams? 10
   - **b** teams of 3? No How many teams? 6
   - **c** teams of 4? Yes How many teams? 5
   - **d** teams of 5? Yes How many teams? 4
   - **e** teams of 6? No How many teams? 3

4. This one is a hard one. There are 24 people. You decide all the different team sizes you could have. Be sure you have everyone playing.
   1 team of 24, 2 teams of 12, 3 teams of 8, 4 teams of 6, 6 teams of 4, 8 teams of 3, 12 teams of 2, 24 teams of 1.

304



How many 2s in 18? **Think** $? \times 2 = 18$ 9

How many 4s in 12? **Think** $? \times 4 = 12$ 3

How many 5s in 20? **Think** $? \times 5 = 20$ 4

How many 3s in 21? **Think** $? \times 3 = 21$ 7

Yes!

You're dividing again. Switch to the symbol for division. Save yourself some reading.

	a	b	c	d
1.	$4\overline{)28}$	$5\overline{)30}$	$2\overline{)14}$	$3\overline{)27}$
2.	$2\overline{)10}$	$3\overline{)24}$	$5\overline{)40}$	$4\overline{)36}$
3.	$1\overline{)9}$	$3\overline{)18}$	$4\overline{)24}$	$5\overline{)35}$
4.	$4\overline{)32}$	$6\overline{)42}$	$5\overline{)45}$	$7\overline{)49}$
5.	$5\overline{)25}$	$7\overline{)63}$	$6\overline{)54}$	$8\overline{)64}$
6.	$6\overline{)48}$	$9\overline{)81}$	$4\overline{)20}$	$7\overline{)56}$
7.	$8\overline{)72}$	$7\overline{)35}$	$6\overline{)36}$	$9\overline{)27}$

305

lesson Pages 305, 306, 307, 308

goal Review of the concept of division; identification of skill with division facts

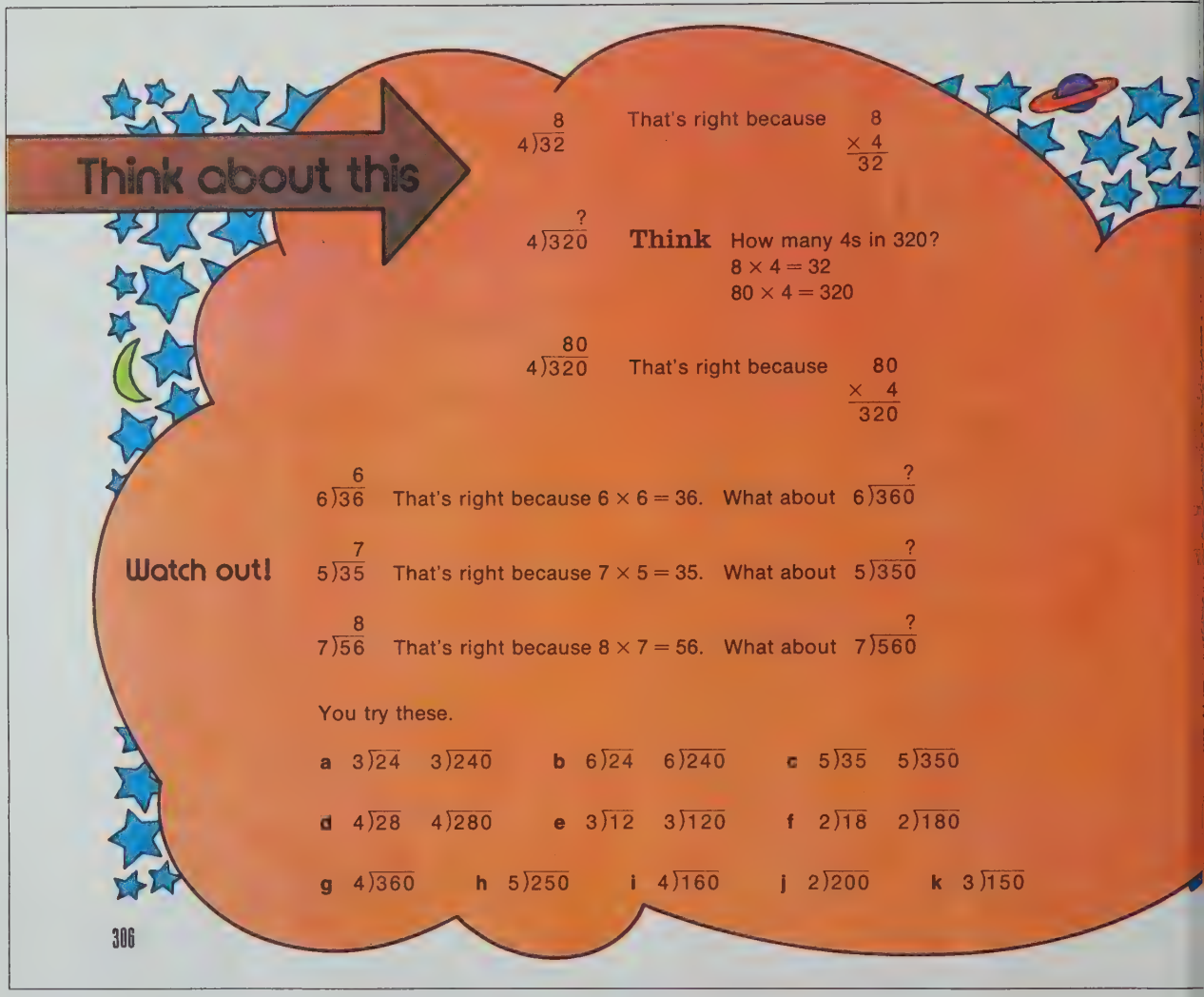
page 305 Recopying all these problems is lots of writing and errors can result in the process. Require answers only. Use folded paper, but this time have the fold put above the problem.

Mastery of division facts is not expected, but a degree of confidence is. Provide more practice if a pupil is particularly insecure in this area.

goal Extension of division skills

memo Pages 306, 307, and 308 are optional—mastery is not expected. These pages develop readiness for skills in level 4. Decide how to use them, considering the expectations of your school's curriculum.

page 306 A heavy emphasis is placed on the use of multiplication skills. Now is the time to apply these skills to division. *Use what you know to learn something new!* This attitude should prevail throughout the development.



Divide some more

	a	b
1.	$2\overline{)4}$	$2\overline{)40}$
2.	$3\overline{)9}$	$3\overline{)90}$
3.	$5\overline{)10}$	$5\overline{)100}$

Don't you feel smart?

WOW!

You didn't let the extra digit fool you, did you? You know $2 \times 5 = 10$, so you know $5\overline{)10}$ also.

	a	b	c	d
4.	$4\overline{)16}$	$4\overline{)160}$	$3\overline{)21}$	$3\overline{)210}$
5.	$5\overline{)35}$	$5\overline{)350}$	$4\overline{)28}$	$4\overline{)280}$

Go slowly on the next ones. Think carefully.
Make sure your answer is reasonable.

$3\overline{)180}$ First think $\underline{?} \times 3 = 18$. Then think $\underline{?} \times 3 = 180$.

$4\overline{)240}$ First think $\underline{?} \times 4 = 24$. Then think $\underline{?} \times 4 = 240$.

You are on your own.

	a	b	c	d	e
6.	$2\overline{)120}$	$3\overline{)60}$	$4\overline{)20}$	$5\overline{)400}$	$2\overline{)180}$
7.	$4\overline{)320}$	$3\overline{)150}$	$3\overline{)240}$	$4\overline{)280}$	$3\overline{)120}$
8.	$5\overline{)300}$	$3\overline{)210}$	$4\overline{)36}$	$5\overline{)450}$	$3\overline{)27}$

307

goal Practice in dividing by a 1-digit factor, no remainders

page 307 Reinforce the readiness developed on page 306. As soon as a pupil shows confidence in what he is doing, he should be able to proceed independently. Watch that ol' buddy Zero!

goal Introduction to finding 2-digit quotients

memo You decide whether your pupils are ready for this skill. Much time is devoted in level 4 to developing and practicing division of this type. A headstart will help though.

page 308 You may simply want to talk through this page to whet appetites for what is to come. With very capable learners you may want to provide even more practice.

This is the next step in division.

Look at this division problem. $3\overline{)33}$ **Think** How many 3s in 33?
$8 \times 3 = 24$ Not enough.
$9 \times 3 = 27$ Still not enough.
$10 \times 3 = 30$ That's closer.
$11 \times 3 = 33$ That's it!

$$\begin{array}{r} 11 \\ 3\overline{)33} \\ -\ 33 \\ \hline 0 \end{array}$$

There is no remainder.

Here's some more. $5\overline{)65}$ **Think** How many 5s in 65?
$9 \times 5 = 45$ Not enough.
$10 \times 5 = 50$ Still not enough.
$11 \times 5 = 55$ Guess again.
$12 \times 5 = 60$ That's closer.
$13 \times 5 = 65$ At last!

$$\begin{array}{r} ?\ 13 \\ 5\overline{)65} \\ -\ 65 \\ \hline 0 \end{array}$$

$2\overline{)26}$ **Think** How many 2s in 26?
$9 \times 2 = 18$ Not enough.
$10 \times 2 = 20$ Still not enough.
$11 \times 2 = 22$ That's closer.
$12 \times 2 = 24$ Even closer.
$13 \times 2 = 26$ That's it.

$$\begin{array}{r} ?\ 13 \\ 2\overline{)26} \\ -\ 26 \\ \hline 0 \end{array}$$

Maybe you can find a better way to divide. $4\overline{)84}$ **Think** How many 4s in 84?
$2 \times 4 = 8$, and $20 \times 4 = 80$.
That saved a lot of time.
Why not subtract that 80?

$$\begin{array}{r} 21 \\ 4\overline{)84} \\ -\ 80 \\ \hline 4 \\ -\ 4 \\ \hline 0 \end{array}$$

20×4
How many 4s in 4? 1
1×4
Now answer.
How many 4s in 84? 21
Where does the answer go? On top.

You will have time to really get good with division later.

308

things egg carton, counters

Discuss with the youngster how he might use the egg carton to help him figure out the quotient for a problem. He could actually count out the number to be divided with counters and partition these counters equally into the number of compartments designated by the divisor. The number of counters in each compartment after partitioning tells the quotient.

CHECKOUT

You have taken some big steps in math.

Review the path you have taken.

Skill: Naming numbers between two numbers

1. Show you remember the numbers between 95 and 105.
   Write them. 96, 97, 98, 99, 100, 101, 102, 103, 104

2. Show you remember the numbers between 1500 and 1510.
   Write them. 1501, 1502, 1503, 1504, 1505, 1506, 1507, 1508, 1509

3. Show how well you know how to add. Skill: Addition with renaming

a	b	c	d	e
234 + 563 = 797	527 + 453 = 980	682 + 139 = 821	41 + 25 + 13 = 79	23 + 12 + 34 = 69

4. And show how you can subtract. Skill: Subtraction with renaming

a	b	c	d	e
568 − 245 = 323	832 − 617 = 215	528 − 369 = 159	608 − 475 = 133	706 − 298 = 408

5. Now multiply. Skill: Multiplication with some renaming

a	b	c	d	e
6 × 7 = 42	9 × 9 = 81	8 × 6 = 48	9 × 7 = 63	7 × 8 = 56

f	g	h	i	j
40 × 8 = 320	17 × 3 = 51	42 × 4 = 168	65 × 6 = 390	54 × 9 = 486

lesson Pages 309, 310, 311, 312

goal **Checkout**—skills developed throughout level 3

memo Your pupils should feel proud of the hard work they have done all year. These four pages will help them realize just how much they have learned. Be generous with praise, especially for those who began slowly and have caught on. Do not let reading difficulty stand in the way.

Skills are identified on the answer key. Require the youngsters to write no more than is necessary. This is a long assignment. You will want to use at least two days, maybe more.

page 309 For additional help for pupils who are having trouble, you will want to refer to the appropriate developmental and practice pages in the pupil text. Remember that the related Resource Sections have ideas also.

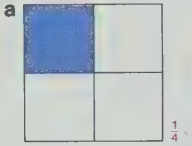
Problem	Refer to Chapter	Page(s)
1	1	17
	3	54–59
2	8	147–151
3a–c	3	65–69
	8	165–168
3d–e	1	10–12
	3	70
4	5	98–103
	8	170–172
5a–e	2	39–51
	7	121–130
	11	225
5f–j	7	131–140

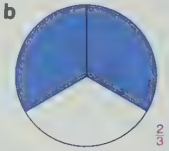
goal **Checkout**—specific skills shown on answer key

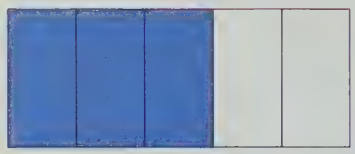
page 310

Problem	Refer to Chapter	Page(s)
6	10	200–201
7	10	212–213
8a	8	147–151
9	4	73–76

6. What fraction is shaded in each of these figures? Skill: Naming shaded parts of regions with fractions

a  $\frac{1}{4}$

b  $\frac{2}{3}$

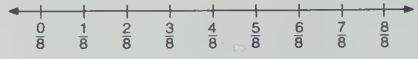
c  $\frac{3}{5}$

d $\frac{2}{2}$ or 1

7. You added fractions, too. Do it again. Use the number line to help. Skill: Addition, fractions with like denominators

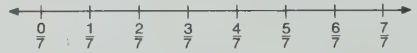
a $\frac{1}{8}+\frac{1}{8}$ $\frac{2}{8}$

b $\frac{3}{8}+\frac{4}{8}$ $\frac{7}{8}$



c $\frac{2}{7}+\frac{3}{7}$ $\frac{5}{7}$

d $\frac{1}{7}+\frac{5}{7}$ $\frac{6}{7}$

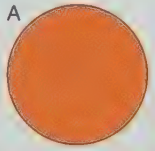


8. You learned how to use the symbols $>$, $<$, and $=$ to make sentences true. Skill: Comparing numbers with relation symbols

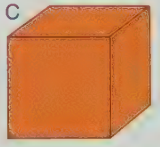
a $5280 \overset{<}{(?)} 5820$ b $\frac{8}{8} \overset{>}{(?)} \frac{1}{8}$ c $0 \overset{<}{(?)} 1$ d $\frac{1}{5} \overset{<}{(?)} \frac{2}{5}$

e $(2+5)+3 \overset{=}{(?)} 2+(5+3)$ f $250+125 \overset{=}{(?)} 125+250$

9. Look at these shapes. Skill: Matching attributes and solid figures

A 

B

C 

a Which has both flat and curved surfaces? B

b Which has flat surfaces but no curved surface? C

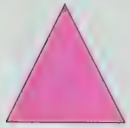
c Which has a curved surface but no flat surfaces? A

10. Look at these plane figures. Skills: Identifying number of sides and corners, recognizing symmetry

a How many sides? 4

b How many corners? 4

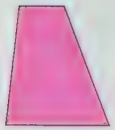
c Could this shape be folded so that one half matches the other? Yes



d How many sides? 3

e How many corners? 3

f Could this shape be folded so that one half matches the other? Yes



g How many sides? 4

h How many corners? 4

i Could this shape be folded so that one half matches the other? No

j Does this figure have any corners? No

k Could this shape be folded so that one half matches the other? Yes

You know about measurements. Skill: Assigning appropriate unit of measure

11. Is this line segment 4 cm, 4 inches, 4 feet, or 4 metres long?

311

goal **Checkout** – specific skills shown on answer key

page 311

Problem	Refer to Chapter	Page(s)
10	4	77–83
11	9	183–189

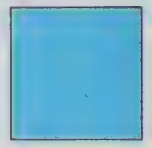
goal **Checkout**—specific skills shown on answer key

page 312 The line segment for problem 12 has none of the measures given. Measuring is a skill that is difficult to test without observing the act of measuring. Have each child actually measure the segment given. Look for evidence of coordination and skill or lack of it. If time allows, measure more things.

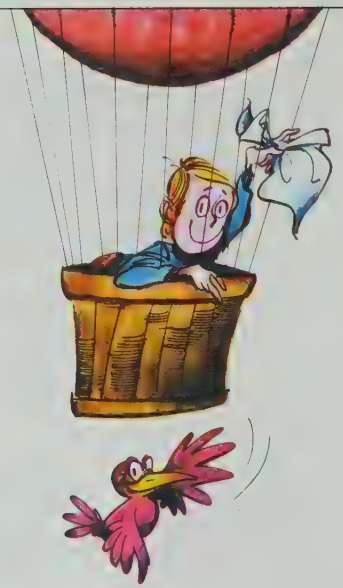
Problem	Refer to Chapter	Page(s)
11–13	9	182–188 194–195
14	9	191, 193
15	14	267–272
16	12	235–242

Skills: Measuring sides, finding perimeter

12. Tell how many inches long one side is. 1
Tell how many inches around the whole thing is. 4



13. Tell how many inches long the longest side is. Tell how many inches around the whole thing. 3 7



Skill: Assigning appropriate unit of measure

14. Is the height of the door in your room between 6 and 10 cm? between 6 and 10 inches? between 6 and 10 ft.?

15. Do most grownups weigh between 100 and 200 grams? between 100 and 200 ounces? between 100 and 200 pounds?

Skill: Telling time to the quarter hour

16. What time do these clocks show?

a

12:30

b

3:15

c

5:45

312

You have come a long way.
You have done a good job.

RESOURCES

activities

1. things for each pupil: 1/2" graph paper, scissors

Have pupils cut out shapes that represent the numbers 1 through 10. Each shape must have only 2 rows of squares. Then ask them to sort the figures into sets representing **even** or **odd** numbers. *How are these 2 sets of figures different? . . . Add 2 even numbers. . . . Is the sum even or odd?* Try several more examples. What about the sum each time?

Next challenge the youngsters to add 2 odd numbers. Encourage the youngster who joins the figures as shown in **a** or **b** to find another way, until he comes up with **c**.

a b c

*Is this answer **even** or **odd**? Will this always happen when you add 2 odd numbers?* Try several more. *Can you think why?* (The 2 single squares always fit together to make a 2.)

Use the same procedure for adding an even and an odd number. *Why will the sum always be an odd number?*

2. things models for 10, 100, and 1000

With youngsters who are having difficulty multiplying 10, 100, and 1000, use model representations for these numbers and a repeated-addition approach.

$$10 + 10 + 10 + 10 = 40$$

Then rewrite the problem into multiplication.

$$\begin{array}{r} 10 \\ \times\ 4 \\ \hline 40 \end{array}$$

3. Check on youngsters who have difficulty with the prerequisite skill of multiplying with a 2-digit factor.

$$\begin{array}{rrrr} 60 & 70 & 20 & 30 \\ \times\ 5 & \times\ 3 & \times\ 3 & \times\ 4 \end{array}$$

Check on those who cannot answer quickly with the basic multiplication facts involved.

$$\begin{array}{rrrr} 6 & 7 & 2 & 3 \\ \times\ 5 & \times\ 3 & \times\ 3 & \times\ 4 \end{array}$$

Proceed to—

$$\begin{array}{r} 6 \text{ tens} \\ \times\ 5 \\ \hline 30 \text{ tens} \end{array}$$

What is another name for 6 tens?

$$\begin{array}{r} 60 \\ \times\ 5 \\ \hline \end{array}$$

What is another name for 30 tens? 300

The youngster who makes a mistake like this— should go back to working with place-value guidelines.

$$\begin{array}{r} 58 \\ \times\ 3 \\ \hline 1524 \end{array}$$

$$\begin{array}{r|l} 5 & 8 \\ \times & 3 \\ \hline 2 & 4 \\ 15 & 0 \\ \hline 17 & 4 \end{array}$$

Emphasize the **think** steps.
(3 × 8)
(3 × 50)

Even with guidelines, errors can pop up.

$$\begin{array}{r|l} 4 & 6 \\ \times & 2 \\ \hline 1 & 2 \\ 80 & 0 \\ \hline 81 & 2 \end{array}$$

Thinking in terms of money may help this youngster.

2×6 pennies = 12 cents
2×4 dimes = 8 dimes or 80 cents

A premature jump to the short form of multiplication can cause mistakes for some youngsters. Convince them that the longer form is a good way to avoid mistakes.

additional learning aids

operation— chapter objectives 1, 2, 3, 4, 6, 9, 10, 11

SRA products

Arithmetic Fact Kit, SRA (1969)
Division cards: 2–22
Computapes, SRA (1972)
Module 3, Lessons: MD 13, 14
Module 4, Lessons: MD 21, 22
diagnosis: instructional aid—Mathematics Level A, SRA (1973)
Probes: L-4, 14
Mathematics Involvement Program, SRA (1971)
Cards: 383, 94, 374, 15, 285, 96, 116, 126
Skill through Patterns, level 3, SRA (1974)
Spirit masters: 67, 68, 69, 70, 71, 72
Visual Approach to Mathematics, level 3, SRA (1967)
Visuals: 17, 21

other learning aids (described on page 312i)— Dividing Machine, I Win, Mathfacts Games, Orbiting the Earth, Veri-Tech Senior (addition and subtraction books), Winning Touch

Number Line 1

Two, three, or four people can play.

You need the Number Line game board and 63 cards (three sets of the 0-to-20 cards). Each player needs a token such as a penny or a button.

Each player puts a token at 100. The first player draws a card from the deck and moves his token backward that many spaces. Then it's the next player's turn.

If a player ends a move on someone else's token, he wins an extra turn. If a player makes a mistake, he goes back where he started from and loses his turn.

The winner is the first player to reach or pass 50.

Number Line 2

This time three cards are dealt to each player. When it is a player's turn, he discards one of his cards and moves that many spaces backward. Then he draws another card so he always has three cards in his hand.

The winner is the one who first lands on 50 by exact count. If a player can't play any card except one that takes him past 50, he discards one card and picks another. But he loses that turn.

Number Line 3

Play with rules for Number Line 1 or 2 but change the end number. Play to 25 or try 0.

Concentration 20

Two, three, or four people can play. Use the cards for the Number Line games. Take out a 10-card so you have 62 cards left.

Put all 62 cards facedown. Spread them out.

The first player turns over any two cards. If the cards show a sum of 20, the player takes them and turns over two more cards. If the cards don't show a sum of 20, the player turns them facedown again and his turn is over.

The next player has a turn, then the next, and so on. Players always take cards that show a sum of 20. Play continues until all the cards are taken.

The winner is the player who has taken the greatest number of cards.

This is the game board for Number Line.

9	10	29	30	49	50	69	70	89	90
8	11	28	31	48	51	68	71	88	91
7	12	27	32	47	52	67	72	87	92
6	13	26	33	46	53	66	73	86	93
5	14	25	34	45	54	65	74	85	94
4	15	24	35	44	55	64	75	84	95
3	16	23	36	43	56	63	76	83	96
2	17	22	37	42	57	62	77	82	97
1	18	21	38	41	58	61	78	81	98
0	19	20	39	40	59	60	79	80	99

START
100

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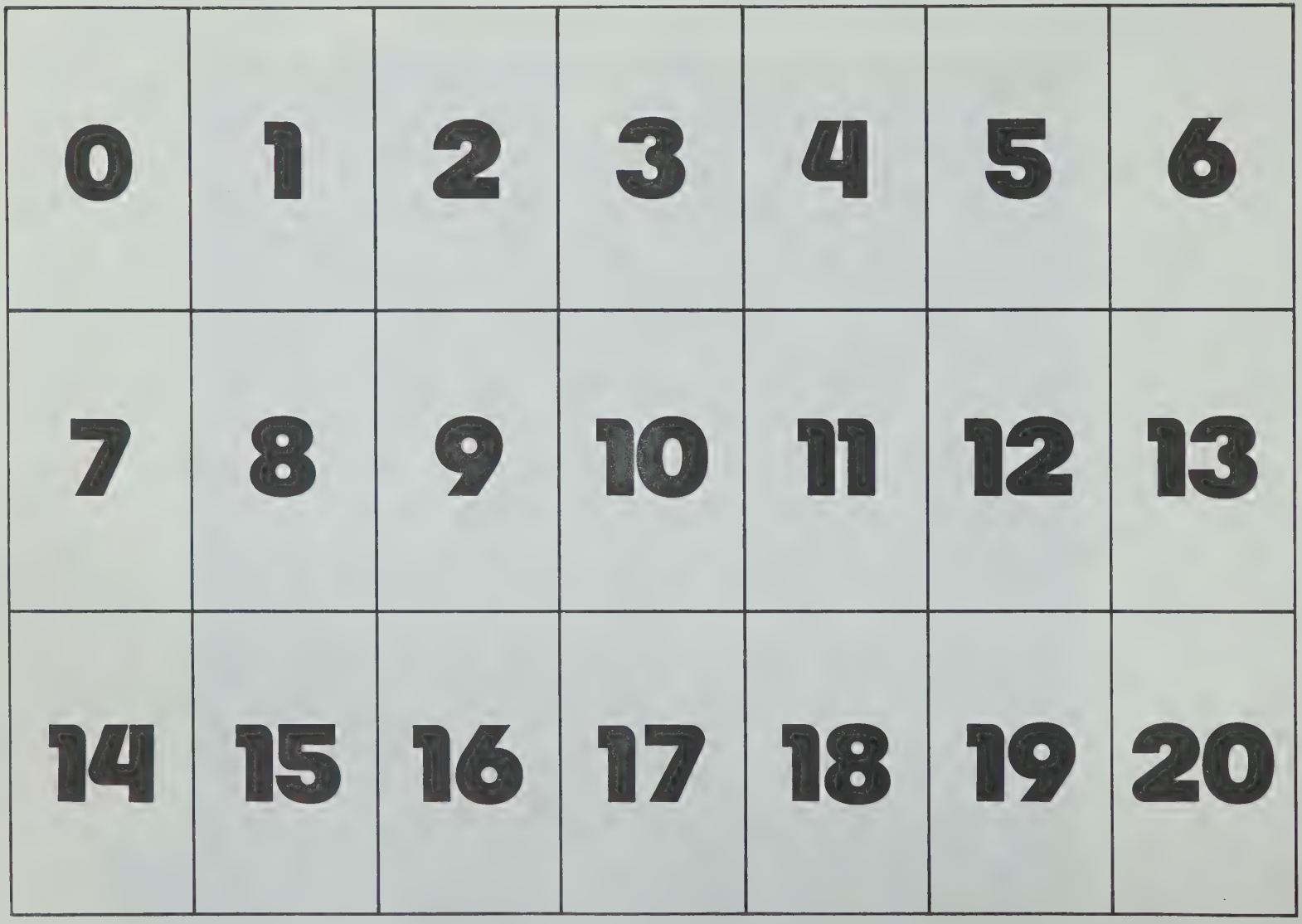
These are the cards for Number Line. You need three set of these.



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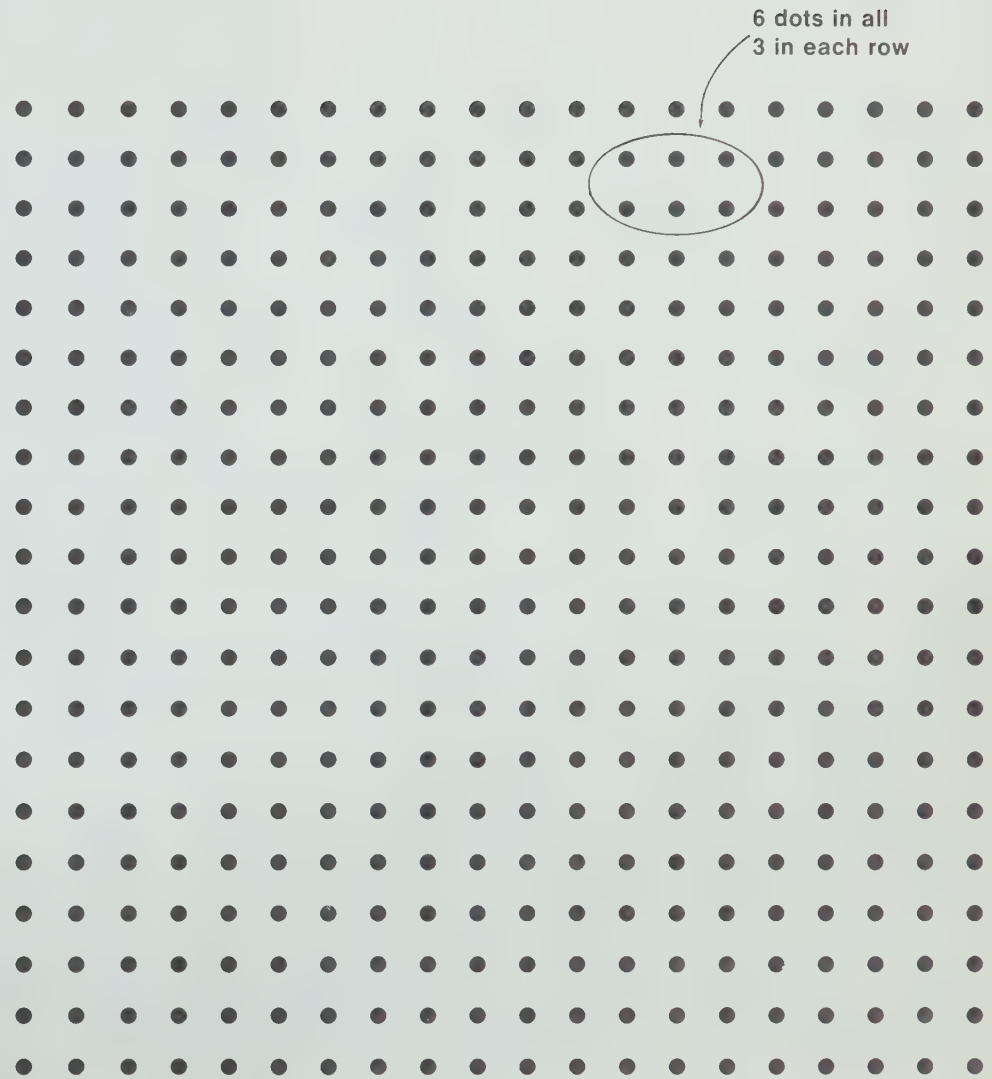
name_____

Ring an array that has –

1. 12 dots in all and 2 in each row.
2. 36 dots in all and 9 in each row.
3. 20 dots in all and 5 in each row.
4. 15 dots in all and 3 in each row.
5. 7 dots in all and 1 in each row.
6. 30 dots in all and 10 in each row.
7. 42 dots in all and 6 in each row.
8. 9 dots in all and 9 in each row.



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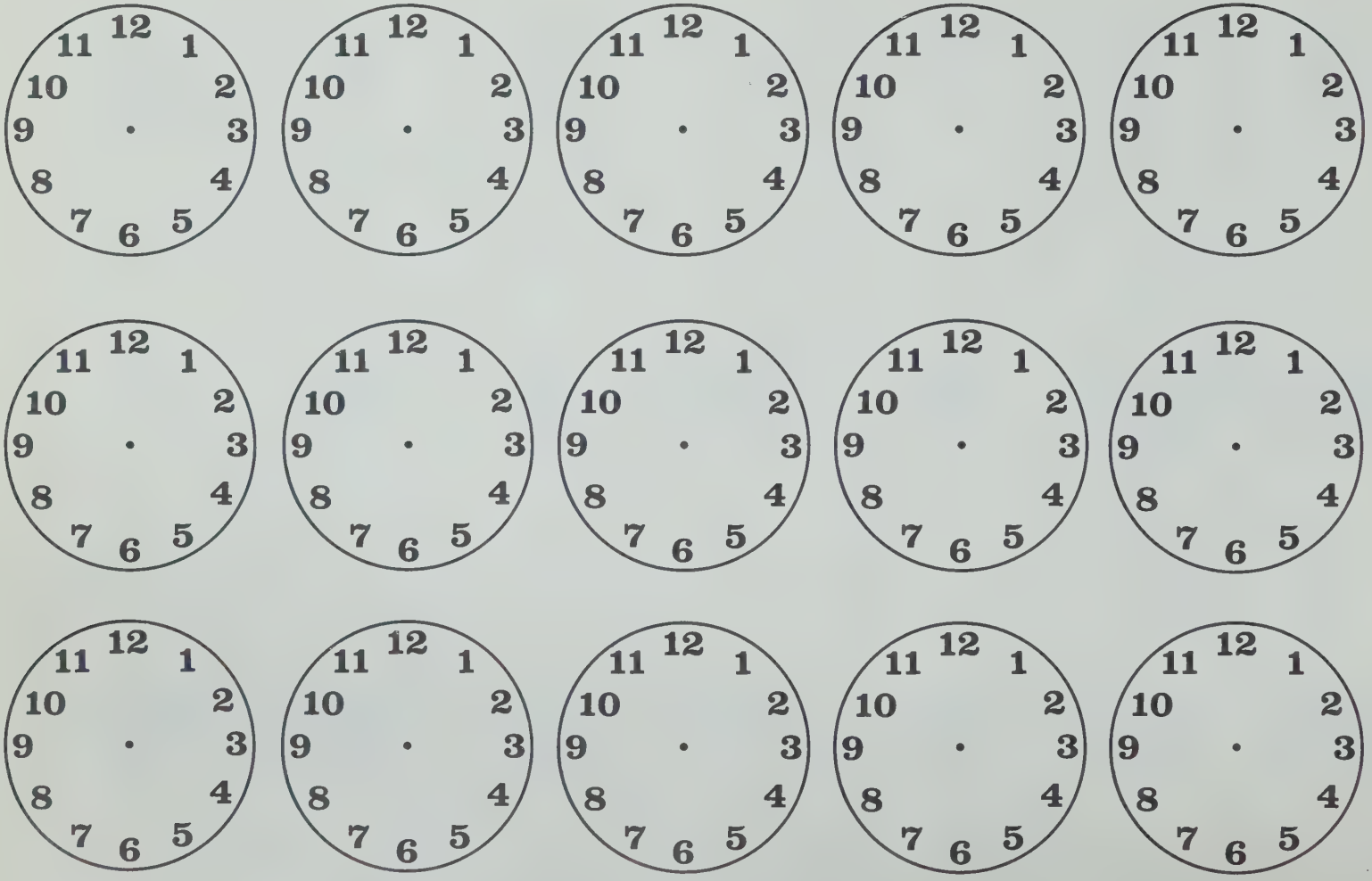
name _____



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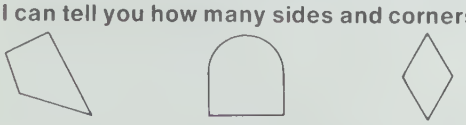
my name _____ my teacher's name _____

	I can do it everytime.	I will be able to do it soon.
I can read and write any number less than 10,000.		
I can tell the value of each digit in a number such as 4567.		
I can name a number that comes between any two numbers less than 10,000.		
I know the answers to problems like these: 9 ×5 8 ×4 7 ×9 4 ×3 3 ×6		
I can find the answer to any problem such as these: 465 +633 304 +276 524 +292 746 +375		
257 −140 145 − 60 32 −15 975 −686		
50 × 5 47 × 3 36 × 2 75 × 6		
I can show that the way I group three 2-digit numbers for addition will not change the answer.		
If you give me a fraction such as $\frac{3}{4}$, $\frac{2}{3}$, or $\frac{3}{8}$, I can make a model to show the fraction.		
I can write a fraction to tell how much is shaded.		
I can show you the numerator and the denominator for any fraction.		
If you give me a pair of fractions with the same denominator, I can tell you which fraction is more.		
I can show you the flat or the curved surfaces on objects.		
I can tell you how many sides and corners on shapes like these: 		
I can tell you what unit to use when measuring such things as the width of a door, the height of a plant, or my own height.		
I can measure anything up to 10 metres or 30 feet long.		
I can tell you the time when the minute hand points to any numeral on the clock.		

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individual progress chart for _____
(pupil's name)

recorded by _____ third-level teacher

evaluation of learning goals	date of 1st try	date of 2nd try	comments
Knows the addition facts (p. 9)			
Knows the subtraction facts (p. 15)			
Knows how to add 2-digit numbers with renaming (p. 23)			
Knows how to subtract 2-digit numbers with renaming (p. 26)			
Knows how to add and to subtract 2-digit numbers with renaming (p. 33)			
*Knows how to add and to subtract 2-digit numbers with renaming (p. 36)			
*Can use multiplication facts to solve word problems (p. 51)			
Knows how to add two 2-digit numbers with renaming (p. 63)			
Knows how to add 3-digit numbers with renaming (p. 68)			
*Knows how to add 2- and 3-digit numbers with renaming (p. 72)			
*Can identify circles, squares, rectangles, and triangles (p. 83)			
Knows the subtraction facts (p. 86)			
*Knows how to subtract 2- and 3-digit numbers with renaming (p. 108)			
*Can identify things that have symmetry			
Knows the multiplication facts (p. 130)			
Knows how to multiply a 2-digit number by a 1-digit number, no renaming (p. 136)			
Knows how to multiply a 2-digit number by a 1-digit number with renaming (p. 140)			
*Knows how to multiply a 2-digit number by a 1-digit number with renaming (p. 144)			
Knows how to add 2-digit numbers with renaming (p. 163)			
Knows how to subtract a 2-digit number from a 3-digit number with renaming (p. 164)			
*Can tell the value of each digit of a 4-digit number (p. 178)			
*Can compare two 2-, 3-, or 4-digit numbers (p. 178)			
*Knows how to add 3- or 4-digit numbers with renaming (p. 178)			
*Knows how to subtract 3-digit numbers with renaming (p. 178)			
*Can compare two metric or customary measurements (p. 196)			
*Can identify the longest of three metric or customary measurements (p. 196)			
*Can write a fraction to tell how much of a region is shaded (p. 216)			
*Knows how to add or subtract two fractions with like denominators (p. 216)			
*Can use division facts to solve word problems (p. 232)			
*Can select an appropriate metric or customary unit to measure an object (p. 243)			
*Can read the weight shown on a scale (p. 243)			
*Knows how to read a bar graph (p. 264)			
Can use a ruler to measure to the nearest inch (p. 282)			
*Can tell the time when the minute hand points directly to a numeral on a clock face (p. 285)			
*Can add time in word problems (p. 285)			
*Can add two measurements in like units (p. 285)			

*Checkout

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Other Learning Aids

whole-number concepts

Abacus board (Creative Publications) Counting board useful for teaching place value
Abacus Spinner Game (Math Shop) Game for recognition and understanding of place value
Chip Trading (Scott Scientific) Several games that develop understanding of place value
Flip-A-Strip Place Value Chart (Developmental Learning Materials) Easel board chart to provide practice with place value and whole-number operations
Place Value I and II (Math Shop) Self-correcting cards to provide practice in reading of numbers through hundred millions

whole-number operations

Calculator (Sigma Scientific) Four place-value calculator for addition and subtraction
Checkermatics (SEE) [level 1] A game for reinforcement and enrichment in whole-number skills
Counting chips (Creative Publications) Plastic disks of eight colors
Cuisenaire Rods® (Cuisenaire) Centimetre rods that provide a concrete approach to developing operations
Dividing Machine (DLM) Device to reinforce basic division facts
Fact-O (Math Shop) Activities for addition and subtraction facts
I Win (Scott, Foresman) [sets 1 and 2] Cards to provide practice in four basic operations
Lots-A-Links (Creative Publications) Plastic links that snap together for counting activities
Mathematical Balance (Mind/Matter) Plastic balance and weights to show relationships between addition and subtraction
Mathfacts Games™(Milton Bradley) [levels 3–5] Self-instructional and self-checking games that deal with the basic facts
Multifax & Quotient (Math Shop) Games in which number sentences are formed
Multiplying Machine (Math Shop) Self-checking machine used to practice the facts
Orbiting the Earth (Scott, Foresman) [addition and subtraction] Game with vinyl playing field for fact practice
Quizmo (Milton Bradley) Lotto-type game that reinforces basic skills with whole numbers
Stamina (Creative Publications) Spinner game providing practice with whole-number operations
Tally and Difference (Creative Publications) Games in which the addition and subtraction facts are used to form number sentences
Unifix Mathematics Classroom Kit (ETA) Set of interlocking cubes that develop understanding of the whole-number operations
Veri-Tech Senior (ETA) [addition, subtraction, and multiplication books] A self-checking device that provides practice with whole-number operations
Winning Touch (Ideal) A game for multiplication facts

fractional-number concepts

Action Fraction Games (Constructive Playthings) Games to develop concepts and skill with fractions
Fraction Bars Student Activity Book (Creative Publications) Games and activities to teach specific objectives for fractions
Fraction Dominoes (SEE) Game involving matching a fractional numeral with its model
Fraction Inlay Boards (General Learning Corp.) Fractional parts of circles or squares
Fraction Line Set (Sigma Scientific) An activity to help visualize operations by computing with fraction strips

geometry

Geoboard Activity Cards (Creative Publications) [primary and intermediate sets] Geoboard activities that lead pupils to explore, compare, and make shapes
Geoboard Kit (Cuisenaire) Plastic geoboards and related activity cards that show basic geometric concepts
Learn to Fold—Fold to Learn (Lyons & Carnahan) Workbook that presents a variety of activities to demonstrate symmetry
Metric Primary Shapes (Invicta) Basic geometric shapes and work cards that reinforce identification skills
Mira (Creative Publications) An aid for investigating properties of plane geometry
Mira Math for Elementary School (Creative Publications) Series of activities to be used with the mira
Paper and Pencil Geometry (Lyons & Carnahan) A geometry book that provides activities to develop basic geometric concepts
Pattern Blocks and Mirrors (Math Shop) Colored blocks used to investigate geometric figures and mirror reflections
Tangrams (Creative Publications) A 7-piece puzzle to be used with tangram shapes
Tangramath (Creative Publications) Book to be used with tangram pieces for exploring concepts of shape, congruence, similarity, and area

measurement

Equal Pan Scales (ESA) Pan balance designed to develop weighing techniques
Judy Clock (General Learning) Movable hands and visible functioning gears to provide learning experiences in telling time
Learning about Measurement (Lyons & Carnahan) A workbook for customary and metric measurement activities
Linear Measures (DLM) A series of linear measuring activities using the customary system
Making and Using Graphs and Nomographs (Lyons & Carnahan) A workbook that develops concepts and skill in the making and reading of graphs
Metric Trundle Wheel (Invicta) Wheel designed to introduce concepts of linear measurement
100 g Balance (ESA) A plastic balance for weighing masses of between 1 gram and 100 grams
Tell-Time Quizmo (Milton Bradley) A lotto-type game to stimulate interests in telling time

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the study of numbers

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**Mathematics for children:* "Sam, a Gerbil Tale." Color w/cassettes. Colonial. (3)

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film, filmstrips* and slides

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**Mathematics for Children:* "The Magic Garden." Color w/cassettes. Colonial. (3)

**Using Modern Mathematics,* Group 4: "Fractions," "Number Line—Fractions." Color w/captions. Singer/SVE. (3)

We Discover Fractions. 16mm, sound, b&w, color. Coronet. (3)

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measurement

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films, filmstrips* and slides

Accuracy in Measurement. 16mm. sound. color. BFA Educ. Media. (3)
**Mathematics for Children:* "Measure Me." Color w/cassettes. Colonial. (3)
Measuring: A Way of Comparing. 16mm. sound. color. BFA Educ. Media. (3)

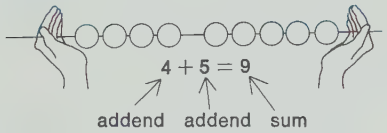
problem solving

children's books

Charosh, Mannis. *Mathematical Games For One or Two.* New York: Thomas Y. Crowell, 1974. (2–4)
Frederique and Papy. *Graph Games.* New York: Thomas Y. Crowell, 1971. (3)
Froman, Robert. *Venn Diagrams: Math to Solve Mysteries With.* New York: Thomas Y. Crowell, 1972. (3–4)
Massoglia, Elinor. *Fun-Time Paper Folding.* Chicago: Childrens Press, 1959. (2–4)
Rothman, Joel, and Tremain, Ruthven. *Secrets with Ciphers and Codes.* New York: Macmillan, 1969. (3–4)
Schulman, Alix. *Bosley on the Number Line* New York: McKay, 1970. (2–3)

GLOSSARY

addition Putting together

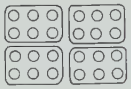


array

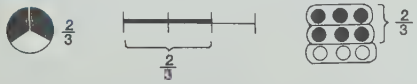
digit Any of the symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

division

$24 \div 6 = 4$ or $6\overline{)24}$ (4 × 6) 0



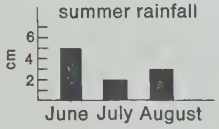
fraction A number that tells how much



$\frac{2}{3}$ ← numerator (how many parts shaded)
$\frac{2}{3}$ ← denominator (how many parts in all)

graph A way of picturing information

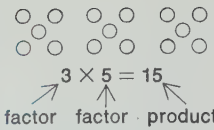
a bar graph:



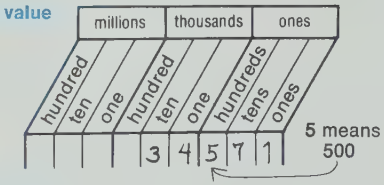
line segment A part of a line

math sentence
addition: $3 + 4 = 7$
subtraction: $16 - 7 = 9$
missing factor: $3 \times \square = 12$
division: $12 \div 3 = 4$

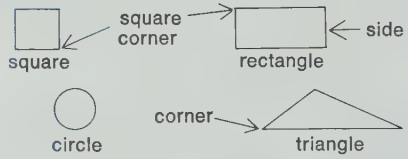
multiplication



place value

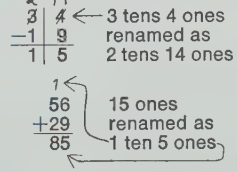


plane figure

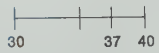


region

renaming

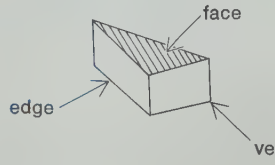


rounding



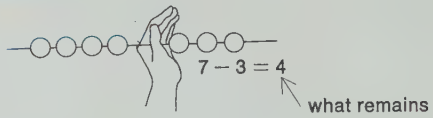
37 is closer to 40 than to 30. 37 rounds to 40.

solid object



standard unit of measure An agreed-upon length, weight, or capacity used to measure things. (See Tables of Measure.)

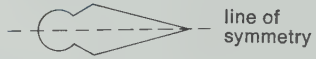
subtraction Taking away



symbol

+	plus	>	is greater than
−	minus	<	is less than
×	times	=	equals
÷	divided by	)	division problem

symmetry Fold along the line. The two parts match.



tally chart A way to record a count

Games Won

Joe	𝍸 ||||
Sam	𝍸 ||

tally marks

whole number Tells how many
0, 1, 2, 3, 4, 5, and the rest of the counting numbers
even numbers—0, 2, 4, 6, and so on
odd numbers—1, 3, 5, 7, and so on

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TABLE

LENGTH

		METRIC	
		10 millimetres (mm)	= 1 centimetre
		10 centimetres (cm)	= 1 decimetre
		10 decimetres (dm)	= 1 metre
		10 metres (m)	= 1 dekametre
		10 dekametres (dkm)	= 1 hectometre
		10 hectometres (hm)	= 1 kilometre (km)
1760 yards (yd.)	= 1 mile		

AREA

144 square inches (sq. in.)	= 1 square foot	100 square millimetres (sq. mm)	= 1 square centimetre
9 square feet (sq. ft.)	= 1 square yard	10,000 square centimetres (sq. cm)	= 1 square metre
4840 square yards (sq. yd.)	= 1 acre	100 square metres (sq. m)	= 1 are
640 acres	= 1 square mile	100 square ares (a)	= 1 hectare
1 square mile (sq. mi.)	= 1 section (of land)	100 hectares (ha)	= 1 square kilometre
36 sections	= 1 township		

WEIGHT

16 drams (dr.)	= 1 ounce	10 milligrams (mg) =
16 ounces (oz.)	= 1 pound	10 centigrams (cg) =
2000 pounds (lb.)	= 1 ton (tn.)	10 decigrams (dg) =
		10 grams (g)
		10 dekagrams (dkg) =
		10 hectograms (hg) =
		1000 kilograms (kg) =

VOLUME

1728 cubic inches (cu. in.)	= 1 cubic foot	1000 cubic millimetre
27 cubic feet (cu. ft.)	= 1 cubic yard (cu. yd.)	1000 cubic centimetr
		1000 cubic decimetre

CAPACITY

Liquid		**Liquid and Dry**	
2 cups (c.)	= 1 pint	10 millilitres (ml)	=
2 pints (pt.)	= 1 quart	10 centilitres (cl)	=
4 quarts (qt.)	= 1 gallon (gal.)	10 decilitres (dl)	=
		10 litres (l)	=
Dry		10 dekalitres (dkl)	=
2 pints (pt.)	= 1 quart	10 hectolitres (hl)	=
8 quarts (qt.)	= 1 peck		
4 pecks (pk.)	= 1 bushel (bu.)		

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